ZANZIBAR PROTECTORATE

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INSTITUTE

ANNUAL REPORT

ON THE

DEPARTMENT OF AGRICULTURE

for the year ended 31st December, 1938.

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DEPARTMENT OF AGRICULTURE.

STAFF.

Rank.		Name.
Director	...	R. W. R. Miller, B.A. (Camb.), Dip. Agric. (Camb.).
Senior Agricultural Officer	...	J. C. Muir, B.Sc.Agric. (Glas.), N.D.A., N.D.D.
Agricultural Officers	...	J. E. Baker, Cert.Agric. (Seale Hayne).
		R. Johns, N.D.A., C.D.A. (Aberystwyth), A.I.C.T.A. (Trinidad).
		A. K. Briant, M.A., Dip. Agric. (Cantab.), A.I.C.T.A. (Trinidad) (from February, 19th 1938).
		F. B. Wilson, M.A. (Cantab.), Dip.Agric. (Cantab.), A.I.C.T.A. (Trinidad). (Seconded as Officer in charge of a commission on Rural Education in the Protectorate from April, 1st 1938).
		G. E. Tidbury, B.Sc., A.R.C.S., A.I.C.T.A. (Trinidad).
Manager of Plantations	...	I. G. C. Squire, (Seconded to Debts Settlement Administration from 1st January).
Temporary Assistant Manager of Plantations	...	J. M. Jamison.
Inspector of Produce	...	A. C. E. Callan.
Government Chemist	...	L. W. Raymond, B.A., B.Sc. Hons. (London), A.R.C.S., A.I.C.
Veterinary Officer	...	Fazal Din Ahmedi, G.P.V.C.

SECTION I.

AGRICULTURE IN THE PROTECTORATE.

GENERAL.

The bulk of the largest clove crop ever recorded in a seasonal year in the Protectorate was gathered by the middle of February, and from that time until the end of 1938 only a negligible harvest has been gleaned.

The welcome finish of the controversy over, the marketing of cloves led to important changes in the buying and exporting of this produce. Since the coming into force of the Binder Marketing scheme, all cloves had been purchased by the Clove Growers Association who appointed their own agents to collect cloves and deliver to central depôts in Pemba and Zanzibar. The agents were remunerated by the Association.

The Clove Decree No. 9 of 1938, provided for free trading in cloves by licensed buyers and exporters. It required the Clove Growers Association to declare prices at which it would purchase cloves and thereby gave producers the option of selling to dealers and exporters or to the Association which is under statutory obligation to purchase all cloves that are offered at the declared prices.

To facilitate the operations of licensed dealers and exporters and with the idea that the best prices would be obtained by producers, markets were established at Zanzibar, Wete and Mkoani, but owing to the complete absence of any dealings in the two Pemba markets a third, projected market, at Chake Chake was not opened. The Zanzibar market has functioned well and regular, though small, supplies of cloves have been offered for sale there and purchased very largely by exporters.

Approximately two-thirds of the cloves offered for sale in Zanzibar have been purchased by exporters and one-third by dealers in Pemba—the Clove Growers Association taking delivery of the balance.

It is pleasing to record that since the inception of the markets no disputes have arisen between the parties and in no case have the referees, for whom provision was made in the 1938 Decree, been called upon.

Under this enactment fifty per cent of all cloves exported must be supplied by the Clove Growers Association, and all those engaged in the export trade have expressed their complete satisfaction at the facilities given for the mixing of their own cloves and those purchased from the Clove Growers Association, which, indeed, has been carried through without the slightest hitch.

LOSS IN WEIGHT OF CLOVES IN TRANSIT BETWEEN PEMBA AND ZANZIBAR.

In the past the cost of handling cloves between markets in Pemba and Zanzibar was borne, it is stated, by the dealer, while in Zanzibar the producer was responsible for all charges until the crop was sold. To enable these dealers to maintain their place in the Pemba market it was agreed, after the clove settlement, that the purchase price of cloves of all qualities should be seventy shilling cents per 100 lbs. less in Pemba than in Zanzibar.

Dealers had asked that this price differential should be considerably larger and Government undertook to carry out a series of experiments to ascertain the correct loss in weight (if any) in shipments of cloves between Pemba and Zanzibar.

Four consignments were weighed before shipment in Pemba and after their arrival in Zanzibar, and while there is a certain amount of evidence that a loss in weight does occur in shipment, the conditions of the experiment and the very small number of bags of cloves available for trial precluded the possibility of any accurate figure of loss being arrived at for the whole crop. Government, considering that the indications pointed to a certain loss, increased the difference between Pemba and Zanzibar buying prices from seventy to ninety shilling cents per 100 lbs. of cloves.

"SUDDEN DEATH" IN CLOVE TREES.

Towards the end of October, Dr. A. H. Campbell, the Plant Pathologist appointed by the Secretary of State for the Colonies under the free grant from the Colonial Development Fund to investigate the causes of the disease known as the "Sudden Death of Clove Trees", arrived in Zanzibar, after conducting certain preliminary investigations at the Imperial Mycological Institute in England.

The rest of the year has been largely spent by Dr. Campbell in investigating the nature and extent of the disease and in determining and developing his lines of attack, and to this end the Director of Agriculture and Dr. Campbell discussed with the Director of the East African Agricultural Research Station, Amani, and his officers the general conditions affecting the investigations.

As a result the Director of the East African Agricultural Research Station, Amani, sent an officer to work in Zanzibar for some three weeks to ascertain the possibilities of different methods of grafting and reproduction of clove trees, especially as regards the prospects for root grafts. At the time of writing it is too early to make a pronouncement upon the success, or otherwise, of these operations

COPRA.

A census of copra kilns in the Protectorate taken during the year gives the following information :—

	In Use.	Under construction or not in use.	Nut Capacity per charge.
Zanzibar	216	41	3,37,600
Pemba	329	57	3,17,260
Totals	545	98	6,54,860

The average production of 400 lbs. of copra per kiln per charge reveals the possibility that already certain areas may be "over-kilned" and this possibility is being investigated.

The decline in copra prices throughout 1938 has been a very severe handicap to the Departmental campaign for better copra, and the present is certainly not the time to introduce rigid methods of grading.

Much good work has, however, been accomplished by the extension and inspection staff, both in the field and in the copra market, to educate producers in the manufacture of better copra, and without resorting to any legislative authority the percentage of rubbery copra has been reduced to not more than thirty in any consignment offered for sale.

It must be emphasized, however, that no radical improvement can be anticipated until world prices rise so that the margin between good and poor qualities of copra is sufficiently great to warrant increased attention to manufacture.

Reports from the French market indicate that the oil content of the lower grades of copra is as large, and in some cases, larger than of the more carefully manufactured product.

EXPERIMENTAL WORK.

The work carried out at the Experimental Station is referred to in more detail later in the report, but the following notes will serve to indicate some of the more important problems which have been dealt with by the Department during the year.

The urgent necessity, in view of (a) increased competition against Zanzibar cloves from Madagascar and (b) the practical application of a new method of preparing vanillin artificially from wood pulp residues in America, of developing new export crops is recognized by Government. The possibilities of developing a trade in high quality canned pine-apples, in creating an export industry in castor oil, in growing our own coffee instead of importing it from the Mainland and in developing a Protectorate cattle industry which would replace our £10,000 annual beef import from Lamu and at the same time provide an extra million gallons of much-needed milk, or its equivalent in ghee, for the indigenous population, together with the extended production of home-grown vegetables and other products are being investigated. It is anticipated that the production stage will shortly be reached of trials which are already in hand of kapok, oil palm and cashew and areca nuts.

PINEAPPLE CANNING.

The Smooth Cayenne pineapple flourishes in Zanzibar—according to expert visitors it excels in size, juice and flavour and is singularly free from the many pests and diseases by which it is attacked in other parts of the world.

It is realized that the world market for canned pineapples is already well supplied, especially that for the inferior qualities of fruit, but, if the quality of the Zanzibar product is good enough, openings may be found for developing an industry, and approximately 750 cans of slices and 500 of juice have been prepared which will shortly be despatched to England for a report on their commercial possibilities.

THE DEVELOPMENT OF A STOCK INDUSTRY.

Year by year approximately £10,000 is exported from Zanzibar to Lamu to purchase a couple of thousand slaughter cattle. These stock, which are understood to be mainly produced in Somaliland, are of very indifferent quality and are a constant source of anxiety as to whether the diseases by which they frequently are afflicted may obtain a footing amongst the cattle of the Protectorate.

A census taken during June and July disclosed that the stock in the Protectorate is made up as follows :—

	Bulls.	Young Bulls.	Cows.	Heifers.	Sucking Calves.	Total.
Zanzibar	449	613	3,495	1,338	1,013	6,908
Pemba	2,275	2,491	10,763	4,737	2,887	23,153
Totals	2,724	3,104	14,258	6,075	3,900	30,061

(There were also at the time of the census 11,025 goats in Zanzibar and 2,906 in Pemba. The number of sheep is not great enough to be of importance.)

Dr. H. E. Hornby, at the time Director of Veterinary Services in Tanganyika Territory, was kind enough to examine these statistics and has, amongst his observations, commented on the very considerable mortality amongst the young stock due to the ravages of East Coast Fever.

Recent work on the West Coast of Africa has shown that a normal increase of 11% per annum may be expected in native herds; a similar increase in Zanzibar and Pemba would amount to 3,300 head, and would be more than ample for our needs.

It is anticipated that the provision of cattle dips, the compulsory dipping of cattle and the improvement of our own stock by selection and the elimination of scrub bulls, would effect this increase and at the same time increase the milk supply by at least one million gallons each year; by this means milk which can only be classed as a condiment in the Protectorate diet would become a part of their normal diet for a large class of the population.

CASTOR OIL.

The larger part of the Protectorate consists of a coral rag locally known as *wanda* country. The soil is shallow and extremely rocky, and the peasants who dwell on it eke out their existence by fishing and the cash they earn as clove pickers.

The sporadic nature of the clove crop at times renders their situation very difficult, and the establishment of a regular export cash crop is of much importance to their prosperity.

The castor oil plant flourishes as a weed throughout this *wanda* country, and three experimental trials have been laid down (one in Zanzibar and two in Pemba) to determine the best varieties and the optimum spacing.

There is no reason whatsoever, provided adequate fire-breaks are established, why large scale export of castor seed should not be developed forthwith in the less productive parts of the Protectorate.

VEGETABLES.

The production of vegetables in Zanzibar has in the past been negligible. There are, however, a number of Indian and other cultivators, who are desirous of developing this industry, and for the last eight months of the year (except for a short period when the plots were flooded by the exceedingly heavy autumn rains) a series of demonstration trials has been conducted at the Experiment Station in which cauliflowers, cabbages, several varieties of string beans, carrots and beet, Barbados squash, lettuce, celery, spinach, radishes, sweet peppers and many other vegetables have been produced continuously and successfully.

These potential producers are being assisted with seed, artificial manures and advice.

PEASANT AGRICULTURAL SURVEY.

Peasant agriculture in the Protectorate is complicated by the conglomeration of races who occupy the land and also by the fact that the land itself is entirely different in the clove growing areas and the *wanda*.

Arabs, Swahilis, and mainland natives who have settled in Zanzibar, together with the indigenous Watumbatu and Wahadimu, obtain a living from the land and a study of the economics of peasant agriculture is much needed in order to ascertain in what way methods of agriculture and crops grown may be improved.

During the year, Mr. F. B. Wilson, Agricultural Officer, who has been seconded to investigate the rural educational system in the Protectorate has, on behalf of the Department of Agriculture, made a study of peasant agriculture and his report will be available shortly.

FOOD CROPS.

The work conducted at the Experimental Station to ascertain the varieties of the different food crops which are most suitable for Protectorate conditions is discussed elsewhere in this report, and the production of better varieties of rice, cassava, maize and sweet potatoes has now reached a stage when this planting material is available in considerable quantities to producers. During the year considerable acreages have been laid down on the Government Plantations for the rapid multiplication of seed, and a particularly fine five-acre stand of selected maize has been grown at Kidichi, the seed of which (estimated at a minimum of six tons) will be distributed to peasants in Zanzibar and Pemba for the spring planting of 1939.

About the middle of 1938, as it became apparent that owing to the failure of the clove crop little cash would be available for the purchase of foodstuffs until the commencement of the next clove harvest, Government decided that every effort should be made to encourage the extension of food plantings, and with this object considerable quantities of maize, rice and bean seeds were purchased from Tanganyika Territory and issued free of charge to producers.

Assisted by exceptionally favourable weather and constant propaganda by the Officers and staff of the Administration (whose ever-ready co-operation in the efforts of this Department it is a great pleasure to record), larger acreages have been put under food crops than at any time during the last decade; there should be no fear of any food shortage amongst producers for the next six months.

POULTRY.

The improvement of native fowls by the issue of pure-bred Rhode Island cocks has continued, but it has been felt for some time that these heavy, slow-moving birds were not always a match for the more virile African village cock, with the result that the proportion of cross-bred chicks has been on occasion disappointing.

To obviate this, an interesting experiment is being tried at a village on the East Coast, where with the assent of the owners all native male birds have been destroyed and replaced by an equivalent number of Rhode Island cocks, so that for the next few months, at least, all chicks hatched will be half-breds. This experiment will be watched closely, as it is possible by this means that in a comparatively short time large quantities of better quality birds may be available for marketing throughout the Protectorate.

WEATHER.

The rains were well up to average and the distribution was such that the period may be described as a good planting year. January and February were normally dry months. The main rains broke in March and persisted into May, providing a good spell for the establishment of plantation crops as rain occurred generally for some 60 days during these three months. June, July, August and September were generally dry and cool and followed by late rains which were heavy and well distributed throughout October, November and December. During the last three months of the year there was unusually great activity in the planting of food crops which was favoured by the prolonged rain.

Meteorological Observations are tabulated in Appendix I.

DOMESTIC EXPORTS.

In Table I a summary of the value of domestic exports is presented. The total value slightly exceeds that of the previous year, due principally to increased exports of cloves and clove stem oil. The most striking feature of the table is, however, the collapse in the value of the coconut crop, which, at £102,062 for copra, coconut oil and fresh coconuts, compares unfavourably with the figure of £208,467 for the same products in 1937. The decrease is in part due to a decreased export of copra, but in greater measure to its lower value.

TABLE I.

DOMESTIC EXPORTS, 1933-38.

Item.	Unit.	1933. Quantity.	1933. Value. £	1934. Quantity.	1934. Value. £	1935. Quantity.	1935. Value. £	1936. Quantity.	1936. Value. £	1937. Quantity.	1937. Value. £	1938. Quantity.	1938. Value. £
Cloves	Cwt.	215,325	496,265	217,514	477,663	189,771	474,513	205,687	618,671	121,128	411,654	157,203	514,964
Clove oil	Lbs.	—	—	—	—	—	—	57,633	8,645	652	98	2,581	323
Stem oil	Lbs.	—	—	—	—	—	—	4,418	663	94,617	11,723	232,937	24,043
Copra	Tons.	12,244	105,271	12,607	71,463	11,694	120,352	13,037	142,686	14,411	204,192	11,697	97,450
Coconut oil	Lbs.	59,115	511	68,770	435	78,875	689	167,664	1,666	109,335	1,349	323,673	2,383
Coconuts	Nos.	925,161	1,827	928,898	1,336	752,980	1,745	1,024,057	2,444	949,187	2,926	1,118,061	2,229
Oil cakes	Cwt.	—	—	—	—	—	—	11,955	2,124	12,828	2,849	16,998	3,586
Fruit fresh	Cwt.	6,623	2,133	7,346	1,877	7,635	2,725	—	1,911	—	1,807	—	1,924
Vegetables	Cwt.	175	172	127	122	313	180	264	129	158	101	90	70
Tobacco unmanufactured	Lbs.	32,240	366	19,275	380	43,181	684	47,650	646	27,750	316	27,765	415
Hides and Skins.													
Ox hides	Cwt.	998	1,243	780	1,058	688	775	338	465	1,186	3,135	410	1,192
Sheep and goat	Nos.	—	—	—	—	—	—	4,800	140	20,046	1,100	13,575	548
Other animals	Nos.	25,160	566	15,726	468	14,205	449	29,000	141	9,618	56	7,001	27
Mangrove bark	Cwt.	—	—	—	—	—	—	—	7,544	—	6,522	6,244	1,102
Total		—	608,354	—	554,802	—	602,112	—	787,875	—	647,828	—	650,256

CLOVES.

Harvesting.—Both in Zanzibar and Pemba, harvesting of cloves took place in the first two months of the year and in the last four. The earlier period represented the termination of the crop of the seasonal year of 1937-38 which was finished in good drying weather. The later period represented the bulk of the meagre harvest of the crop year 1938-1939 which was a late season or *vuli* crop. This was harvested in both islands in unusually prolonged and heavy rains, which caused difficulty in drying and had an adverse effect on the quality of the cloves. In the early months of the year labour was scarce and expensive, but in the late months of 1938 clove pickers were easily obtained for the small harvest.

Calendar Year (1938).—The total deliveries of cloves for sale during 1938 are summarized below :—

Origin.		lbs.	Frasilas of 35 lbs.
Zanzibar	...	5,523,572	157,816
Pemba	...	15,138,904	432,540
Total	...	20,662,476	590,356

Of the total of 590,356 frasilas which came on to the market during the period only 76,291 belong to the crop season of 1938-39, the balance of 514,065 frasilas belonging to the crop year of 1937-38.

Seasonal Year (1937-38).—In marked contrast to that of the previous season, which was then the lowest on record in Zanzibar District, the crop of the seasonal year 1st July, 1937, to 30th June, 1938, was the largest known, as was similarly the case in Pemba District. The total deliveries of cloves were :—

Origin.		lbs.	Frasilas of 35 lbs.
Zanzibar	...	15,627,507	446,500
Pemba	...	31,829,560	909,416
Total	...	47,457,067	1,355,916

Crop deliveries over a period of 35 seasons are shown in Appendices II and III.

Clove Markets.—From the beginning of the year until 31st July the purchase of cloves from producers within the Protectorate was solely in the hands of the Clove Growers Association under the authority given by the Clove (Purchase and Exportation) Decree of 1937. When this was replaced by the Clove Decree, No. 9 of 1938, which came into effect on 1st August, other licensed buyers in addition to the Clove Growers Association were able to purchase cloves from producers.

As an aid to sellers and to dealers, clove markets were created in Zanzibar Town and at two centres in Pemba. At the Zanzibar market cloves were examined for moisture content and extraneous matter on arrival and after being passed for sale were weighed by a Government officer and a certificate of weight issued. Provision for the settlement of disputes regarding quality standards was made by the appointment of referees. The clove market in Zanzibar Town was used regularly from its inception, those in Pemba were not, sellers there conveying their produce direct to a licensed buyer and inspection taking place, as in former years, at Pemba ports.

Inspection.—Examination of cloves under the Adulteration of Produce Decree took place in the usual manner, the figures tabulated below summarizing the results of inspection in Zanzibar Town. Of the Pemba cloves approximately 3% had been previously failed at Pemba ports.

TABLE II.

EXAMINATION OF CLOVES UNDER THE ADULTERATION OF PRODUCE DECREE, 1934.

Origin.		Delivered (bags).	Passed (bags).	Failed. Excess Moisture (bags).	Failed. Extraneous Matter (bags).	% Failures.
Zanzibar	...	48,652	45,602	1,431	1,619	6
Pemba	...	147,326	146,988	338	Nil	Nil
Total	...	195,978	192,590	1,769	1,619	1.7

All produce was eventually passed after drying and re-conditioning. The high proportion of failures for excessive extraneous matter was due to the offering of wind fallen cloves gathered from the ground together with small pieces of twigs and stones.

In the early months of the year, when the remnants of the 1937-38 crop was being harvested and weather conditions were good, producers' supplies of cloves were presented in good condition. The small crop of 1938-39, the bulk of which was being collected from September onwards, suffered from unusually prolonged late rains with a consequent fall in quality owing to the impossibility of rapid picking and drying of the crop. For the same reason failures for excessive moisture content were higher than in the early part of the year, 4% of all cloves received between August and December being rejected.

On 10th January, by General Notice No. 41, clove stems were brought under the provisions of the Adulteration of Produce Decree and thereafter stems were examined for dryness and extraneous matter content when presented for sale in the Clove Market at Zanzibar or at Pemba ports. Eleven per cent of stems of Zanzibar origin and 26% of those from Pemba were failed on first inspection chiefly on account of the presence of extraneous matter. In Pemba, plantation owners who possess a surfaced drying ground are very few in numbers, hence the greater proportion of failure in stems arriving from that island.

Declared Buying Prices.—As in the previous year, declared buying prices for various qualities of cloves were issued under the authority of the Clove Growers Association Decree (Cap. 118), producers having the option of selling freely to the Association or to other licensed dealers.

The buying prices at the beginning of 1938 were those which had been in existence in 1937, the subsequent variations in declared prices being tabulated below. It may be well to make clear at this stage that the purchase price of cloves from growers is made on a basis of "qualities", and that actual grading does not take place until cloves are being packed for export.

PRICE RANGE IN SHILLINGS PER 100 lbs.

General Notice No.	District.	Quality. Good.	Inter-mediate.	Fair.	Poor.	Inferior.	Sweepings.	Clove stems.	Inferior clove stems.
112 of 3.2.38.	Zanzibar	41.00		38.00	33.00 to 37.50	30.00 to 33.00	12.00 to 20.00	3.00 to 6.00	
	Pemba	40.50		37.50	32.50 to 36.50	29.50 to 32.50	11.50 to 19.50	2.00 to 5.50	
548 of 2.7.38.	Zanzibar	51.00	48.00	46.00	36.00 to 40.00	30.00 to 35.00	12.00 to 20.00	7.00	3.00 to 6.00
	Pemba	50.30	47.30	45.30	35.30 to 39.30	29.30 to 34.30	11.30 to 19.30	6.50	2.50 to 5.50
1039 of 10.12.38.	Zanzibar		46.00						
	Pemba		45.30						
1112 of 31.12.38.	Zanzibar	51.00	46.00	44.50	36.00 to 40.00	30.00 to 35.00	12.00 to 20.00		
	Pemba	50.10	45.10	43.60	35.10 to 39.10	29.10 to 34.10	11.10 to 19.10		

The greater portion of the year's supplies of cloves was purchased by the Clove Growers Association in the early months of the year, but the light supplies at the end of the period were taken up partly by the Association and partly by

other licensed dealers, who were, in many cases, paying more than the declared prices. For all qualities the average price paid by the Association during the year was shillings 36 cents 77 per 100 lbs.

Exports.—During 1937 a virtual boycott by the Indian markets resulted in abnormally low exports of cloves from the Protectorate, and this condition persisted in the early part of the year under review. With the passing of the Clove Decree and a settlement with exporters, there was some revival in shipments to India and to other markets which had been buying in hand-to-mouth manner owing to uncertainty regarding the eventual outcome of the dispute with the Indian clove market. The export for the year was 17,606,396 lbs. compared with 13,565,920 lbs. in 1937 and 23,036,971 lbs. in 1936.

As a further result of the operation of the Clove Decree, the exporter was obliged to purchase at least one-half of each consignment for export from the Clove Growers Association; and the Produce Inspection shed of the Department was placed at the disposal of exporters in order that the building up of composite bulks of graded cloves obtained by mixing their direct purchases with those cloves which they had purchased from the Clove Growers Association could be facilitated. This method proved convenient to the merchant and the Produce Inspection staff, who were able to examine each bag of cloves as it was emptied on the heap prior to packing for export.

The table below shows the destinations of cloves exported during the past three years and also the declared average value of the exports per 100 lbs.

TABLE III.

CLOVE EXPORTS FOR THE CALENDAR YEARS, 1936, 1937 AND 1938.

(In standard bales of 140 lbs.)

Destination.	1936.	1937.	1938.
Dutch East Indies ...	80,451	46,856	74,490
India ...	51,221	11,699	28,047
United States of America ..	15,542	13,539	14,215
Great Britain ...	5,303	8,739	3,293
Germany ...	2,613	8,109	—
Straits Settlements ...	—	—	550
All Other Ports ...	9,419	7,960	5,165
Total ...	164,549	96,902	125,760
Declared value per 100 lbs. weight in shillings and cents ...	53.51	60.69	58.50

The export of clove stem oil again increased and, as in previous years, was examined and certified by the Government Chemist. The distribution of clove and stem oil was as recorded below :—

CLOVE OIL.

Destination.	Quantity in lbs.	Total lbs.
Great Britain ...	2,581	2,581

CLOVE STEM OIL.

Great Britain ...	210,780	
Holland ...	11,324	
Austria ...	5,061	
United States of America ...	3,272	
Germany ...	2,500	232,937

Export Grading.—A new grade of cloves for export known as Intermediate Grade was introduced on 1st August with standards falling between those of Grades I and II. At the same time some revision was made in the standards of other grades, the existing descriptions of which are given in Section IV of this report under Government Notice No. 40. Intermediate Grade is intended for the use of the Indian market when supplies of Grade I cloves are not available.

The tables which follow give the results of grading by months and by grades.

TABLE IV.

INSPECTION AND GRADING OF CLOVES FOR EXPORT, 1938.

Month.	Inspected and Graded. Bales*	Passed. Bales.	Failed. Bales.
January ...	6,958	6,958	Nil.
February ...	4,808	4,808	,,
March ...	14,779	14,779	,,
April ...	9,223	9,223	,,
May ...	8,763	8,763	,,
June ...	7,252	7,252	,,
July ...	16,293	16,293	,,
August ...	3,758	3,758	,,
September ...	8,166	8,166	,,
October ...	4,996	4,996	,,
November ...	4,090	4,090	,,
December ...	9,710	9,710	,,
Total ...	98,796	98,796	Nil.

TABLE V.

GRADES OF CLOVES EXPORTED, 1938.

Special Grade. Bales.*	Grade I. Bales.	Intermediate Grade. Bales.	Grade II. Bales.	Grade III. Bales.	Technical Grade. Bales.
...	812	7,906	79,070	5,593	5,415
...	1%	8%	80%	6%	5%

It is of interest to observe from the table above that no export bales were failed when presented for inspection and grading and that once more no Special Grade cloves were exported.

COCONUTS.

General.—1938 was a poor year for the coconut grower, the prices of nuts and copra being at low levels and the crop less than normal. The average price of copra was shillings 6 cents 28 per 100 lbs. compared with shillings 10 cents 62 in 1937 and shillings 9 cents 71 in 1936.

Taking advantage of improved quality copra at low prices, the local oil crushers increased their output of oil which, at 323,673 lbs., is the highest export of this commodity which has been recorded.

In the prevailing circumstances it was not expected that great headway would be made with the further improvement of copra quality; nevertheless some progress was made, and it was possible to make a slight reduction in the percentage of defective matter allowed in consignments offered for sale.

Inspection.—At the start of copra inspection there was some doubt in the minds of copra makers, particularly in Pemba, as to their ability to produce copra of the standard set by the Department of Agriculture, and as a result a trade in the sale of nuts to copra makers in Zanzibar was commenced. With a growing realization that their earlier fears were not justified, many of the people have since reverted to copra manufacture with a consequent fall in nut exports to Zanzibar. The figures below show the position during the past three years.

COCONUTS EXPORTED FROM PEMBA TO ZANZIBAR.

Year.	No. of Nuts.
1936 ...	6,259,000
1937 ...	4,167,000
1938 ...	751,000

*Bales vary from 112 to 185 lbs. according to destination.

The figures for the inspection of local copra are summarized below. It should be mentioned, however, that copra of Pemba origin had previously been inspected and reconditioned at Pemba ports, when approximately 9% had been failed upon first examination. As in former years, all copra was passed after reconditioning.

TABLE VI.

EXAMINATION OF COPRA IN ZANZIBAR TOWN DURING 1938.

Origin.	No. of bags delivered.	No. of bags passed.	No. of bags failed for Moisture.	No. of bags failed for Extraneous Matter.	% Failed.
Zanzibar ...	133,735	123,491	9,541	703	8
Pemba ...	73,975	73,684	180	111	—
Total ...	207,710	197,175	9,721	814	5

Tanganyika copra was formerly superior to that of Zanzibar and was imported in large quantities to mix with the latter to improve the quality of our local product. As quality improved locally, there was some falling off in this trade by the voluntary action of local copra buyers. In September, 1938, it became clear that for some time our copra had been used to grade up imported inferior Tanganyika Territory produce, and for that reason the entry into the Protectorate of copra more than 40% defective was prohibited. The quantity and value of copra imported from Tanganyika Territory during the past five years is shown below.

COPRA IMPORTED FROM TANGANYIKA TERRITORY TO ZANZIBAR.

Year.	Quantity. tons.	Value. £
1934 ...	1,085½	5,152
1935 ...	166	1,449
1936 ...	149	2,070
1937 ...	474	7,039
1938 ...	263	1,973

The percentage of copra classified according to method of manufacture is given below, the figures having been compiled from examination of copra in the local market. It is necessary, however, to point out that the gross percentage of kiln-dried copra is higher than the figure of 22% would suggest, as the output of good quality copra from two large manufacturers and from the Government Plantations is not exposed for sale in the local copra market. The inclusion of the production from these owners would raise the kiln dried portion to some 35 per cent.

	%
Smoke dried ...	49
Sun dried ...	29
Kiln dried ...	22

Contrasted with the comparative figures for the previous year, there was a diminution in smoke drying and kiln drying and an increase in sun drying resulting from a prolonged spell of favourable weather at the beginning of the year.

One problem of local importance in the improvement of copra is the training of the copra manufacturer. Many of those who are engaged in this occupation are Arabs from Muscat. From time to time there is an entry of inexperienced people who engage in this trade without any form of preliminary training and a corresponding exodus of experienced people upon whom much time and effort have been spent by members of the Department.

Exports.—The total crop exported was 11,697 tons, the lowest recorded for seven years. The distribution of exports is tabulated below :—

TABLE VII.

COPRA EXPORTS, 1938.

Destination.		Quantity in tons.
France	...	10,136
Italy	...	1,294
Holland	...	49
Germany	...	98
Great Britain	...	49
India	...	22
Belgium	...	49
Total	...	11,697

OTHER EXPORT CROPS.

Fruit.—The fruit crop exported, which consists chiefly of oranges, was valued at shillings 38,480 compared with shillings 36,140 during the previous year. The orange grader mentioned in the previous annual report was little used.

Tobacco.—The local tobacco industry was almost similar in volume to that of the previous year, but there was some increase in value, the figures for 1937 and 1938 being 27,750 lbs. valued at Shillings 6,320 and 27,765 lbs. valued at Shillings 8,300 respectively. There is also a local trade in this tobacco for native snuff making.

Mangrove Bark.—Worthy of mention is the small export of mangrove bark derived principally from Pemba. This is a product which is exploited when prices are satisfactory and neglected when they are not. The export of 6,244 cwts. was valued at Shillings 22,040.

VETERINARY.

A summary of the data obtained and the conclusions reached from an analysis of the cattle census figures is presented earlier in this report.

The figures of live stock slaughtered in Zanzibar Town, which are given below, show that the slaughter stock imports are the greatest for the past three years. This is a result of general prosperity in the early months of 1938 following a good clove harvest. Imports were lower and sales less in the second half of the year as money became less plentiful.

TABLE VIII.

ANIMALS SLAUGHTERED AT MUNICIPAL ABATTOIR, ZANZIBAR.

	Species.		1936.	1937.	1938.
Imported Stock.	Cows	...	151	...	44
	Oxen	...	1,381	1,327	1,912
	Calves	...	10	...	...
	Goats	...	5,302	5,236	6,627
	Sheep	...	1,359	2,412	3,030
Local Stock.	Cows	...	531	902	290
	Oxen	...	218	348	57
	Calves	...	101	132	42
	Goats	...	3,652	2,804	1,819
	Sheep	...	...	...	...

The castration of superfluous and undesirable type of bull calves was continued on a small scale with the voluntary co-operation of owners.

Funds were provided by Government for purchasing a Montgomery bull and two cows from India, but the animals could not be secured.

Disease.—There were no widespread outbreaks of animal disease during the period. A few cases of Redwater occurred amongst imported dairy stock which owners had neglected to dip.

The occurrence of isolated cases of trypanosomiasis in cattle in dairies near Zanzibar Town was recorded in 1937. More extensive tests were made in the course of this year and trypanosomes were found in cattle fairly frequently, particularly in the southern part of Zanzibar District.

The Tsetse fly which may infect cattle with trypanosomiasis has not been found in Zanzibar and the disease can only be spread through the agency of one of the biting flies.

Individual cases have been treated successfully with Potassium Antimony Tartrate, but no general measures for the eradication of the disease have yet been possible.

Epidemics of fowl typhoid have occurred during the period with heavy losses of birds. At one centre the Veterinary Officer was reluctantly permitted by the owners to inoculate a number of fowls with anti-typhoid vaccine obtained from the Department of Veterinary Services, Kabete, Kenya. The trial was a spectacular success for they were practically the only fowls left alive in the area when the disease had run its course.

Veterinary Education.—The Veterinary Officer continued the general training of the two pupils to whom reference was made in the report for 1937. They have now received a grounding in the elements of veterinary work including meat inspection, the use of the microscope and examination of blood smears, the symptoms, treatment and control of the more common cattle diseases which they are likely to encounter, and also training in animal husbandry.

The two pupils will be stationed in Pemba with the sole object, for some time, of becoming acquainted with stock owners and acquiring such knowledge of the details of the livestock industry as will enable future work to be planned.

The Veterinary Officer undertook the training in meat inspection of a class of Sanitary Inspectors who attended a series of lectures and were also regularly present at the municipal abattoir to witness routine meat inspection.

SECTION II.

WORK OF THE DEPARTMENT OF AGRICULTURE.

GENERAL.

Agricultural Education.—The training of field assistants for work in the Department of Agriculture was continued. Four third-year pupils proceeded with their studies in agriculture at the Experiment Station and two were attached to the Veterinary Officer during the whole of their third year for specialized training in the elements of Veterinary Science and Animal Husbandry. At the end of the year the six were appointed to the staff of the Department as Agricultural Assistants.

As in recent years, the greatest portion of the time of the district extension staff of the Department has been expended upon the copra maker, but the utilization of some clove nursery sites as centres for keeping pens of Rhode Island Red poultry is attracting attention from people who would be too shy to visit the Experiment Station to enquire about these and other items.

EXPERIMENTAL WORK.

CLOVES.

Nursery Work.—No new investigations were undertaken during the period, the objective of the year being to increase the number of nurseries so as to increase the radius of distribution of selected planting material. To this end four new nurseries were constructed in Zanzibar and four in Pemba. In 1938 clove seedlings were issued as follows :—

Zanzibar	...	23,000
Pemba	...	59,658
Total	...	82,658

Establishment of Clove Seedlings.—The clove seedling is not easily established and casualties during the first year in the field are high. A trial to test the value of a simple complete mixture of artificial fertilizers as an aid to the establishment of seedlings during their first year in the field was made, the artificials being supplied to mulched and unmulched plants. The mulching material used was lemon grass which lasts well and does not appear to attract termites. Mulch was supplied to the plants at the time of planting and thereafter renewed when necessary. The lay-out was a 4×4 Latin Square, each plot containing 25 clove seedlings at seven feet espacement. Superphosphate at the rate of 1 lb. per plant was applied in January and Sulphate of Ammonia and Sulphate of Potash at the rate of $\frac{1}{4}$ lb. per plant in May when seedlings were planted.

At the end of the year analysis of the records showed that there were no significant differences between plots attributable to the application of artificial fertilizers, and that mulching, with or without artificials, resulted in significantly less mortality amongst seedlings.

Variation in the Oil Content of Cloves from Individual Trees.—An investigation into the oil content of clove buds derived from 19 high yielding trees was continued during the year with the assistance of the Government Chemist. In the first trial green cloves were used, but it became evident that variation between

samples due to different degrees of ripeness was likely to mask differences, if any, due to inherent high or low oil content. To overcome this all the crop from each tree was picked and subjected to similar drying and storage conditions so far as was possible; although irregular ripening introduced unavoidable differences in the period of drying which may have influenced the final results.

On the completion of the harvest the mature cloves from the crop of each tree were separated from those which were overblown and imature, and final samples, obtained by quartering the mature cloves, were analyzed with the results shown below. The variations in oil and eugenol contents are of sufficient interest to warrant the repetition of the tests with a more carefully controlled technique.

Tree Number.	Average annual yield in lbs. of dry cloves.	Percentage Oil.	Percentage Eugenol.
165	20.2	17.95	94.5
594	20.4	17.94	94.5
119	21.9	17.60	92.0
166	29.7	18.79	95.0
195	22.1	19.01	94.5
231	20.4	18.60	93.5
253	27.3	20.47	95.0
236	21.8	19.47	92.5
215	21.0	18.79	93.5
246	26.1	17.95	93.0
276	22.6	16.88	97.0
224	18.9	18.93	90.5
544	23.9	16.39	96.0
122	20.4	16.70	96.0
420	18.2	18.60	94.5
286	18.8	17.00	93.0
204	16.1	16.26	94.0
225	20.3	18.52	95.0
249	22.6	17.54	95.5
Mean	21.7	18.07	94.2

Clove Stems Preparation.—Clove stems supply a not inconsiderable part of the revenue of the clove grower, forming, as they do some 20 per cent of the volume of his crop of clove buds and realizing about 20 per cent of the price of poor quality cloves. The stems are used for oil distillation, and the price paid is dependent on condition and appearance as it is not possible to analyze each consignment for oil content. The major part of the oil is used for the manufacture of vanillin. In the press of a busy harvest the clove stems are largely disregarded, owing to lack of drying space, until the crop of clove buds has been disposed of. The stems, under such circumstances, are usually thrown into heaps and left for weeks exposed to the elements and untouched.

An experiment was undertaken in conjunction with the Government Chemist to determine the effects of exposure and delay in commencing the drying of clove stems compared with rapid drying.

In Tables IX and X which follow data is presented in respect of batches of stems which had been dried immediately after collection and of other batches heaped in the open for periods of 30, 60 and 90 days before drying.

Table IX.

Expt. No.	Method of drying.	Period of exposure to the weather (days).	Rainfall during period of exposure. (inches).	No. of rainy days.	Weight of dry stems from 100 lbs. green.	Percentage composition of dry stems.			Weight of oil and oil-free-dry matter from 100 lbs. green stems	
						Moisture.	Oil.	Oil-free dry matter.	Oil.	Oil-free dry matter
1	Kiln, 48 hours	—	—	—	36.7	12.8	6.2	81.0	2.28	29.7
2	Sun, 7 days	—	—	—	34.2	13.4	6.35	80.25	2.17	27.4
3	Sun, 5 days	—	—	—	31.9	13.0	5.95	81.05	1.90	25.9
4	Sun, after weathering	30	9.37	14	19.3	7.6	8.5	83.9	1.64	16.2
6	do.	30	0.97	6	25.2	8.8	6.8	84.4	1.71	21.3
7	do.	60	10.34	20	17.6	8.6	7.85	83.55	1.38	14.7
9	do.	60	1.36	15	23.5	12.6	6.25	81.15	1.47	19.0
8	do.	90	10.73	21	21.2	8.8	5.95	85.25	1.26	18.0
10	do.	90	15.13	38	14.5	6.4	5.7	87.9	0.83	12.8

TABLE X.

Experiment No.	Eugenol in oil per cent.	Lbs. of eugenol from 100 lbs. green stems.
1	95.5	2.18
2	97.0	2.10
3	96.5	1.83
4	90.5	1.48
6	93.5	1.60
7	92.0	1.27
9	92.5	1.36
8	90.5	1.14
10	85.5	0.71

The conclusions which may be drawn from these results are :—

(a) Kiln-drying gives the greatest yield of dry stems and the greatest total yield of oil.

(b) Exposure to the weather leads to a loss in final weight and consequently a reduced financial return.

(c) The valuable constituent of the clove oil, eugenol, is reduced by weathering.

(d) The oil content of weathered stems is sometimes, but not always, higher than of quickly dried sound stems, but in view of the reduced eugenol content badly weathered stems are less valuable than sound stems.

With care a grower can obtain at least 35 lbs. of dry stems per 100 lbs. of green, but weathering may reduce the yield to as little as 15 lbs., which is less than one-half of the possible yield. Growers should, therefore, make more use of kiln-drying of stems in heavy crop years and should endeavour, at all times, to reduce the period of exposure of heaped stems and dry them with as little delay as possible.

Pollination Experiments.—The inflorescence bagging trials referred to in the report for 1937 were continued without the production of viable seed and thereafter a single seedling at the bearing stage was isolated for the purpose of observing the ability of the clove tree to produce self-fertilized seeds under natural conditions. It is not yet possible to record the results.

"*Sudden Death*" *Investigations.*—The appointment of a Plant Pathologist in an attempt to elucidate the condition of clove trees known as "sudden death" is noted in Section I of this report. The officer's investigations are not yet complete, but, it is considered, that the following summary, compiled by Dr. A. H. Campbell, of the lines along which he is working and of the progress which has so far been made will be of general interest.

The large number of hypotheses and explanations of the "sudden death" condition of clove trees, advanced at one time or another, has made it necessary to carry out this investigation upon the widest possible basis. Thus the condition has been attributed to parasitic attacks upon the roots by a fungus, *Peziza caryophyllata* Welsford, while a "dying-back" of the branches and subsequent death of the tree has been described by Professor Troup as the work of a melolonthid beetle, *Idaecamenta eugeniae* Arrow. Such physiological factors as drought, water-logging, nutrient deficiency, minor element deficiency, hard pan in the soil, effect of "fuwi" in Pemba, old age, bad or irregular cultivation, with mechanical damage to the roots, have also been advanced as possible causes. Similar investigations in Madagascar appear to be equally inconclusive. A new suggestion, made by Dr. Storey of the East African Agricultural Research Station, Amani, that the disease might be due to a flagellosis comparable to Stahel's phloem-necrosis of the Liberian coffee had also to be examined in greater detail, while the possibility that a virus disease might be responsible required investigation.

The symptoms known as "sudden death" of the clove tree are simply those of a rapid wilt and subsequent death and drying-out of the leaves. At the earliest stage at which these symptoms can be recognized, there has already taken place an almost complete loss of the absorbing root-system. It is clear that the diseased condition of the roots is much older than the leaf symptoms of "sudden death". It is possible that the disease of the roots may be of long standing, and that the final phase of the disease, the wilting and discolouration of the leaves, is brought about by the coincidence of a number of factors. The chief of these is probably the drying power of the atmosphere, and it is significant that the greatest number of casualties occur from December to April, when the highest temperatures accompanied by strong winds are experienced.

In view of the apparent sensitivity of the clove tree to environmental factors, particularly drought, it is possible that sporadic casualties, designated "sudden death" simply on the wilt symptom, are due to different agencies in varying localities and conditions of growth. On the other hand, it is reasonable to assume that the apparently epiphytotic "sudden deaths" of areas such as Kizimbani are all attributable to the same cause. It has been shown statistically that there is a definite tendency for affected trees to occur together and for areas which have been previously badly affected to continue to show many casualties. It may be deduced from this that either there is a spread of infection from one tree to another or that a definite predisposition to "sudden death" is brought about by the particular soil conditions in the affected areas. A spread of infection from tree to tree would appear to be the more probable explanation.

The relation of the widespread condition known as "die-back" to "sudden death" is not at present understood. The comment in the previous paragraph about sporadic occurrences would appear to be equally applicable to both these conditions. The failure of "die-back" trees to make the adequate recovery expected of vigorous trees following mechanical damage is indicative of some other agency being concerned in preventing recovery.

Progress has been made with studies of the normal and pathological anatomy of the clove tree. Particular attention has been given to the phloem tissues of "sudden death" material, in view of the suggestion that a necrosis of the phloem might be responsible for the disease. Structurally, the phloem of "sudden death" and healthy material is identical and is normal for its type, consisting of latticed sieve-tubes, crystallogenous cells and numerous fibres. So far the abnormal phloem divisions described by Stahel for necrotic material have not been seen nor has any evidence of the existence of flagellates been obtained.

Chiefly as a development of the hypothesis of a flagellosis of the phloem, Mr. Gibbins of the East African Agricultural Research Station, Amani, visited Zanzibar from November 26th to December 10th in order to experiment in a technique of root-grafting necessary for a study of this condition. Mr. Gibbins also carried out other grafting operations and started some propagation work on the clove tree.

In order to test an idea that a localized phloem necrosis might produce in effect a "ringing" of the affected tree, recognizable by the concentration of starch above the "ring", a survey of the starch distribution in healthy and "sudden death" material has been carried out. This was done microscopically as the presence of large quantities of readily-soluble tannin throughout the tree prevents the use of a macroscopic method. Briefly, it may be said that starch is fairly evenly distributed in the parenchyma of root, stem and branch of the healthy tree, but that it cannot be detected by iodine in similar tissues of the "sudden death" tree. Its place is apparently taken by a brown, amorphous, presumably decomposition product in the diseased material.

It has previously been observed that "sudden death" trees have lost most of their fibrous root system. A search for an organism which might be responsible for this condition has resulted in the discovery of very numerous pycnidia of a fungus belonging to the Sphaeriodeae on the dead rootlets and roots of the 84 "sudden death" trees so far examined. Similar pycnidia have been found on the dead roots of trees showing severe "die-back". The association of this fungus with "sudden death" trees appears to be constant for a number of localities, so a

detailed study is being made to discover its exact relation, if any, to the disease. An intensive search has been carried out at the same time for a fungus answering to Miss Welsford's somewhat inadequate description of "*Peziza caryophyllata*", but without result. It is of interest to report that pycnidia, similar to those that are being studied, have been found upon specimens placed in the Museum by Miss Welsford to demonstrate her fungus.

Until the provision of my present laboratory, the study of this pycnidial fungus in pure culture was seriously delayed. The possibility that the final symptoms and the characteristically rapid death of "sudden death" trees may be brought about by the secretion of a specific or non-specific toxin by the fungus growing in the roots is now under investigation. Support seems to be given to this idea by the increase in the number of "sudden death" casualties during the period at which water-loss from the leaves may be expected to be greatest, inducing increased movement and concentration of solutions from the roots throughout the whole tree.

Although the "sudden death" of clove trees has been recorded for at least twenty years, little seems to be known of its distribution in the Protectorate, apart from the Government shambas. A survey of "sudden death" and severe "die-back" has now been undertaken, which, I hope, will provide a permanent basis for all such work in the Protectorate. In the photographs derived from the experimental aerial survey of certain areas in Zanzibar and Pemba, carried out for Sir Ernest Dowson, individual clove trees can be quite readily distinguished. The procedure is simple; an area photographed, for example, in 1935, is identified on the ground and the subsequent history of each tree shown in the area of the survey is recorded. The loss of trees in the interval may generally be attributed to "sudden death", but at the same time enquiries on the shamba supply a correction for losses due to fire and other agencies. So far, about 5,000 trees have been recorded in Zanzibar, while it is expected that a further 25,000 will be similarly recorded in Pemba by April 1st, 1939. The completed survey will supply essential data upon which estimates of both the losses to the Protectorate and the cost of remedial or ameliorative measures can be based.

COCONUTS.

Seed Selection.—The high yielding palms reported upon in previous years were harvested regularly and nuts from the highest copra yielders planted in nursery beds for the establishment of progeny rows in a block. The seeds from the remaining palms were sold to the public.

Uniformity Observations.—A group of 600 palms was taken at random within a coconut block on the Experiment Station for the purpose of studying the variation within the palm population as an aid to future experimental work.

OTHER PERENNIAL CROPS.

Kapok.—The Java importations planted in the field during 1936 continue to thrive and some trees gave a small crop during the year. Three varieties, Saigon, Mixed Java Seed and Sarawak Sewagan, were established in the field in isolated blocks.

Oil Palms.—The area continues to thrive, some palms having flowered for the first time.

Coffee.—A small block of Liberica coffee was planted in the Experiment Station and 4,000 seeds of Liberica and 1,000 of Excelsa coffee planted in nurseries.

ANNUAL CROPS.

Maize.—The yellow maize varieties referred to in the report of 1937 were again planted in small observation plots. Sahara and Eksteen were failures and were abandoned, while Peruvian yielded a good crop which was reserved for further trial. Two further yellow varieties, Funk's Yellow Dent and Ontario Yellow Flint imported from the United States of America, are now under trial.

Cassava.—A permanent area for the testing of virus resistance in new importations of cassava was laid out by the establishment of hedge-like rows of cassava of the variety Mbarika which is markedly susceptible to this disease.

All new varieties are planted between the diseased hedges, observations on comparative disease resistance are made and markedly susceptible varieties rejected without further trial. Seventeen varieties were under test in this manner.

The following varieties of West Indian origin planted in 1937 and harvested during the period were discarded on account of poor flavour :—

Parasol	Jamaica No. 2
Mama l'enfant	Jamaica No. 3
Turkey	Jamaica No. 5
Sellier	

The variety trial for 1937-38, an 8 × 8 Latin Square, was harvested early in the year and proved that the varieties Msitu and F.100 were superior in yield to Kajayeye, Binti Athmani, F.279, Mbarika, Msheli and Kijiti. The two high yielding varieties are thus confirmed as being at present the best on the Experiment Station and will be used as standard controls in the 1938-39 variety trial which also includes the varieties Mpezaze, Sareso, Kru, F.20, F.64 and Pamba Mangubu.

Sweet Potatoes.—Seven varieties imported from Barbados were grown successfully. Two of these, B.44 and Black Rock, were rated as equal in quality to the best Zanzibar potato, Halimtumwa. One Barbados variety, Caroline Lea, a yellow fleshed potato, was rated as superior in flavour to all the others.

Rice.—A variety trial in which the six varieties, Gamti, Malikora, Shingo ya Mjane, Cheche, Rey 20 and S.K.36 were compared for yield was conducted. The experimental design was a 6 × 6 Latin Square with 1/120th acre plots. Seed was first sown in nursery beds and transplanted to the plots at a spacing of 1 foot by 1 foot.

Analysis of the results showed that Rey 20, S.K.36 and Cheche produced larger yields of paddy than any of the others and that Shingo ya Mjane gave a higher yield than either Gamti or Malikora.

Rey 20 and S.K.36 were imported from Malaya, while Cheche is a local variety. The Malayan varieties were more vigorous in growth and almost a month later in ripening than those of local origin. The performance of Cheche was encouraging, as it has not yet been subjected to careful selection.

The calculated yields per acre were :—

Varieties.		Calculated Yield of Paddy per acre in lbs.
Rey 20	...	3,787
S.K.36	...	3,758
Cheche	...	3,698
Shingo ya Mjane	...	3,275
Gamti	...	2,880
Malikora	...	2,811

Small supplies of the high yielding varieties have been issued to the public.

Legumes.—Popondo beans (*Phaseolus sp.*) continue to maintain their early promise as a food and cover crop and small quantities have now been distributed. Chora, a type of cow pea (*Vigna sp.*) imported from Tanganyika Territory, appears to be a better yielder than local types.

Several varieties of Soya beans (*Glycine hispida*) were imported, but only one, Barberton Yellow, could be tried during the year. Initial growth was poor and an examination of the root systems of the plants revealed that no nodule formation had taken place. It was thought advisable to introduce and attempt to establish in the soil flora a strain of Rhizobium, and the Department was fortunate enough to receive cultures from the Bureau of Plant Industry, United States of America.

Replanting of the seed and the supply of the organism resulted in more normal growth and the presence of nodules on the roots of the crop was general.

Preliminary trials with Mauritius peas were successful.

West Indies and Punjab varieties of pigeon peas were introduced in 1937. The varieties from the West Indies went down to a severe "canker" and were destroyed, those from the Punjab, which are still under trial, gave a small crop.

POULTRY.

The flock of Rhode Island Red fowls was maintained on the Experiment Station, the average number of eggs laid by each laying bird being 101.2. This is a lower figure than that of recent years and is due to the poor performance of some of the pullets. To counteract this, an increased use has been made of trapnests. A few fowls hatched in 1934 have been retained on account of their proven vigour and good egg laying capacity and their off-spring are doing well. Distributions to the public included 1,377 setting eggs and 119 chickens.

The mash portion of the ration used in poultry feeding at the experiment station has been changed as is shown below :—

Original Mash.		Present Mash.	
Bran	3 parts	Bran-blood mixture	4 parts
Maize Meal	1 part	Maize Meal	1 part
Millet Meal	1 part	Millet Meal	1 part
Coconut Meal	1 part	Coconut Meal	1 part
Shark	10 per cent	Salt	1 per cent
Salt	1 per cent		

The bran-blood mixture is made by the addition of three parts of fresh blood to two of bran, which is stirred thoroughly and sun dried, lumps being broken up by hand. The protein content of the present mash is similar to that of the former and is cheaper as the blood is obtained from the local slaughter house.

FARMERS' DAY.

A successful "Farmers' Day" was held at the Experiment Station which was toured thoroughly by a party of 45 farmers, 20 of whom came from Pemba.

GOVERNMENT PLANTATIONS.

The report of the Manager of Plantations, which forms Appendix IV, calls for no particular comment. The clove crop harvested during the year was a small one and coconuts and copra were at low levels. The area of plantations was further reduced by the sale of isolated properties. The Manager of Plantations assisted the District Staff in crop trials with maize, castor and pineapples on certain selected plantations.

OTHER WORK OF THE DEPARTMENT.

Chemical Investigations.—The report of the Government Chemist forms Appendix V. Of special value to this Department was the work on the effect of weathering on clove stems exposed under normal plantation conditions, the analyses performed on cloves from selected single trees and the utilization of blood in the manufacture of a blood-bran mixture for poultry feeding.

Public Gardens.—The public gardens, avenues and open spaces in Zanzibar Town were maintained as usual.

Publications.—A paper by Mr. R. Johns, Agricultural Officer, entitled "Zanzibar Coconut Palm Yields and Seed Selection" was published in the East African Agricultural Journal.

SECTION III.

FINANCIAL STATEMENT.

The revenue and expenditure of the Department are summarized below. From Personal Emoluments a sum of shillings 26,320 has been deducted on account of the salaries of the Manager of Plantations and of one Agricultural Officer who were seconded to the Debts Settlement Administration and to An Enquiry into Rural Education, for twelve months and nine months respectively.

EXPENDITURE.

Item.	Shs.	Cts.	Amount. Shs.	Cts.
Personal Emoluments	272,258	01		
Less	26,320	00	245,938	01
Other Charges		...	227,338	44
Special		...	26,508	46
Total		...	499,784	91

REVENUE.

Item.		Amount. Shs.	Cts.
Sale of Cloves	...	56,522	26
Sale of Copra and Coconuts	...	86,792	50
Produce Inspection Fees	...	13,550	80
Miscellaneous	...	6,915	14
Total	...	163,780	70

Net expenditure is reduced by some 37,600 Shillings and revenue by fully 142,600 Shillings, the reduction in revenue being due principally to a smaller clove crop and lower copra prices than in 1937.

Two small Government Plantations in Pemba were disposed of for the sum of 5,325 Shillings.

SECTION IV.

LEGISLATIVE CHANGES AFFECTING AGRICULTURAL INDUSTRIES.

The year was again marked by a large volume of legislation affecting agriculturists.

	Reference No.	Title.	Date of Introduction.
1.	Government Notice No. 6 ...	Under the Agricultural Produce Decree No. 13 of 1937 ...	15. 1.38
2.	Decree No. 2 of 1938 ...	The Land Protection (Debts Settlement) Decree No. 2 of 1938 ...	1. 2.38
3.	General Notice No. 112 ...	Under the Clove Growers Association Decree (Cap. 118) ...	3. 2.38
4.	Government Notice No. 11 ...	The Plant Protection (Importation of Pine-apples) Order, 1938 ...	1. 3.38
5.	General Notice No. 358 ...	Under the Diseases of Animals Decree of 1923 (Cap. 128) ...	30. 4.38
6.	General Notice No. 506 ...	Under the Clove (Purchase and Exportation) Decree No. 15 of 1937 ...	23. 6.38
7.	General Notice No. 548 ...	Under the Clove Growers Association Decree (Cap. 118) ...	2. 7.38
8.	Decree No. 9 of 1938 ...	The Clove Decree No. 9 of 1938 ...	28. 7.38
9.	Government Notice No. 33 ...	The Clove (Licences) Rules under the Clove Decree No. 9 of 1938 ...	28. 7.38
10.	Government Notice No. 34 ...	The Clove Rules under the Clove Decree No. 9 of 1938 ...	28. 7.38
11.	Government Notice No. 35 ...	The Clove (Dhow Transport) Rules, 1938 under the Clove Decree No. 9 of 1938 ...	28. 7.38
12.	Government Notice No. 36 ...	The Clove (Clove Bag Levy) Order, 1938 under the Clove Decree No. 9 of 1938 ...	28. 7.38
13.	Government Notice No. 37 ...	The Clove Grading and Export (Amendment) Rules, 1938 under the Agricultural Produce Export Decree (Cap. 116) ...	28. 7.38
14.	Government Notice No. 39 ...	The Transfer of Agricultural Produce (Form of Instrument) Order, 1938 under the Transfer of Agricultural Produce Decree (Cap. 121) ...	28. 7.38
15.	Government Notice No. 40 ...	The Agricultural Produce (Amendment) Rules, 1938 under the Agricultural Produce Decree No. 13 of 1937 ...	28. 7.38
16.	General Notice No. 610 ...	Under the Agricultural Produce Decree No. 13 of 1937 ...	30. 7.38
17.	General Notice No. 611 ...	Under the Clove Decree No. 9 of 1938 ...	30. 7.38
18.	General Notice No. 612 ...	Under the Clove Decree No. 9 of 1938 ...	30. 7.38
19.	General Notice No. 613 ...	Under the Clove Decree No. 9 of 1938 ...	30. 7.38
20.	General Notice No. 658 ...	Under the Clove Decree No. 9 of 1938 ...	2. 8.38
21.	General Notice No. 659 ...	Under the Clove Decree No. 9 of 1938 ...	11. 8.38
22.	Government Notice No. 48 ...	The Customs Management (Import Prohibition) (Copra) Order, 1938 under the Customs Management Decree (Cap. 91) ...	10. 9.38
23.	Government Notice No. 70 ...	The Clove Grading and Export (Amendment) (No. 2) Rules, 1938 under the Agricultural Produce Export Decree (Cap. 116) ...	10.12.38
24.	General Notice No. 1039 ...	Under the Clove Growers Association Decree (Cap. 118) ...	10.12.38
25.	General Notice No. 1112 ...	Under the Clove Growers Association Decree (Cap. 118) ...	10.12.38

Government Notice No. 6.—Declares cloves, mother of cloves and clove stems, whether green or dried, to be agricultural produce for the purposes of Section 9, 10 and 11 of the Agricultural Produce Decree No. 13 of 1937 with the primary object of ensuring that stems are adequately dried and cleaned.

The Land Protection (Debts Settlement) Decree.—This Decree is a comprehensive one for the settlement of the indebtedness of local agriculturists where debts have been secured by mortgages on their land. A certain portion of the debts has been caused by accumulation of arrears of interest. In brief, the method to be adopted consists in adjudication of the amount of the debt by a Debts Court, the indentification of the properties and settlement of the title to the land by a Settlement Officer, and finally the evaluation of the capital value of the land by a Valuation Officer. If the valuation is equal to or greater than the adjudicated debt Government will assume the mortgages and pay out the lenders, Government obtaining re-payment of the capital and interest at a reasonable rate over a period. Where the valuation is less than the adjudicated debt the lender is paid to the extent of the valuation and Government assumes the mortgage, subsequently recovering this amount from the borrower together with the balance of the adjudicated debt due to the original mortgagor.

General Notice No. 112.—This notice indicated the prices which would be paid for cloves in the Protectorate during the season commencing 1st July, 1937. The prices were graduated for Good, Fair, Poor and Inferior qualities and for sweepings and clove stems.

Government Notice No. 11.—Prohibits the importation under Section 8 (1) of the Plant Protection Decree of pineapple plants or fresh fruit in view of the healthy condition of the local product and the attempt being made to institute an industry in the canned product.

General Notice No. 358.—Prohibits movement of fowls between Pemba and Zanzibar on account of fowl typhoid.

General Notice No. 506.—The buying authority to Agents of the Clove Growers Association was made operative until 31st July, 1938, at which date other legislation had come into force.

General Notice No. 548.—This notice varied the prices of cloves previously announced in General Notice No. 112.

The Clove Decree (No. 9 of 1938).—May be summarized by the first paragraph of the "Objects and Reasons" which were published with the Bill and read as follows :—

> "This Bill replaces the Clove (Purchase and Exportation) Decree, 1937, under which the right to deal locally in cloves and to ship cloves for exportation was restricted to a single licensee. In conformity with an understanding reached between the Government and representatives of the Indian community, the Bill extends freedom of purchase and exportation to the public generally under licence, subject to conditions which are designed to protect the interest of producers and to enable the Government through the Clove Growers Association to maintain control over the prices obtained for cloves in foreign markets."

Government Notices Nos. 33, 34, 35 and 36.—Provide conditions for the detailed working of the Clove Decree No. 9 of 1938.

Government Notice No. 37.—These Rules made under Section 5 of the Agricultural Produce Export Decree (Cap. 116) provide for the preparation of an additional grade of cloves to be known as Intermediate Grade which falls between Grades I and II in quality. This grade is intended to serve the Indian market, which demands a high quality product, when supplies of Grade I cloves are not available. The standards of grades exported are as shown below :—

Special Grade.—Good sound cloves which are whole, bright, bold, uniform, regular, free from mustiness and which contain no khoker cloves and not more than—

1% of stems, mother of cloves, and foreign, superfluous or inferior matter, and
16% of moisture.

Grade I.—Good sound cloves which are bold, reasonably regular, of good colour, free from mustiness and which contain not more than—

3% of stems, mother of cloves, and foreign, superfluous or inferior matter,
2% of khoker cloves, and
16% of moisture.

Intermediate Grade.—Good sound cloves, which are bold, reasonably regular, free from mustiness and which contain not more than—

5% of stems, mother of cloves, and foreign, superfluous or inferior matter,
3% of khoker cloves, and
16% of moisture.

Grade II.—Cloves which are free from mustiness and which contain not more than—

5% of stems, mother of cloves, and foreign, superfluous or inferior matter,
7% of khoker cloves, and
16% of moisture.

Grade III.—Cloves which contain not more than—

5% of stems, mother of cloves, and foreign, superfluous or inferior matter,
20% of khoker cloves, and
16% of moisture.

Technical Grade.—Either—

(*a*) Cloves which contain not more than

5% of mother of cloves, and foreign, superfluous or inferior matter,
30% of khoker cloves,
20% of stems, and
16% of moisture, or

(*b*) the clean dried inflorescence of the clove tree (that is to say commercial clove stems from which the buds have not been removed) containing not more than 5% of mother of cloves and foreign superfluous or inferior matter and 16% of moisture.

Government Notice No. 39.—The effect of this Order under the Transfer of Agricultural Produce Decree (Cap. 121) is to extend the security offered by the instrument to cover, in addition to the original cash advance on a growing crop, any subsequent advance made during the continuance of the instrument which, by an amendment to the Decree itself, is now effective for two years in the case of a transfer of interest in clove buds or clove stems and one year in the case of other agricultural produce.

Government Notice No. 40.—This amendment provides that a dealer in cloves and in other agricultural produce need not pay more than once licence fee in respect of the same premises.

General Notice No. 610.—This notice appoints the Municipal Officer to issue licences to deal in cloves within the Town of Zanzibar.

General Notice No. 611.—The Director of Agriculture is appointed Licensing Authority for the purpose of issuing licences to export and to store cloves.

General Notice No. 612.—Appoints officers to hear and determine disputes under Section 21 (1) of the Clove Decree, 1938.

General Notice No. 613.—Under powers conferred by Section 12 of the Clove Decree, 1938, the exportation of cloves of Grade II to India is prohibited.

General Notice No. 658.—By powers under Section 12 (1) paragraph (b) of the Clove Decree, 1938, the use of Grade III cloves is restricted to distillation for the purpose of the manufacture of clove oil and that of Technical Grade to distillation for the purpose of the manufacture of vanillin.

General Notice No. 659.—Under Section 12 of the Clove Decree, 1938, the exportation of cloves of Grade II to a number of places within easy transhipment distance of the Indian markets is prohibited.

Government Notice No. 48.—In exercise of powers conferred by Section 47 of the Customs Management Decree copra containing extraneous matter or more than 40% of defective matter or is not commercially dry is debarred from entry into the Protectorate. Certain inferior qualities were being imported from Tanganyika and re-exported as Zanzibar copra.

Government Notice No. 70.—Under powers given by Section 5 of the Agricultural Produce Export Decree (Cap. 116) the fee for the examination of cloves prior to export is standardized at ten shilling cents per bale or package.

General Notice No. 1039.—Notification of a price range for cloves of Intermediate quality.

General Notice No. 1112.—Notification of a change in price ranges of the various qualities of cloves.

R. W. R. MILLER,
Director of Agriculture.

APPENDIX I.

SUMMARY OF METEOROLOGICAL OBSERVATIONS, 1938.

1st Order Station. CHUKWANI, ZANZIBAR. **Non-Clove Growing Area.**

Latitude 6° 15′ S. Longitude 39° 13′ E. Altitude 69 feet. Standard time 2h. 45m. East.

Month	Atmospheric Pressure* 8.30	Atmospheric Pressure* 14.30	Temperature Dry Bulb 8.30	Temperature Dry Bulb 14.30	Temperature Dew Point 8.30	Temperature Dew Point 14.30	Vapour Pressure 8.30	Vapour Pressure 14.30	Saturation Deficit 8.30	Saturation Deficit 14.30	Relative Humidity 8.30	Relative Humidity 14.30	Total Cloud Amounts 8.30	Total Cloud Amounts 14.30	Number of Occasions of Cloud Amounts at 8.30: 0	1-3	4-6	7-9	10	Rainfall: Total mm.	Rainfall: Total ins.	Rainfall: Max fall in 24 hrs.	Rainfall: Date	Number of days of: Rain	Number of days of: Thunder
	ins.	ins.	F	F	F	F	mbs.	mbs.	mbs.	mbs.	%	%										ins.				
January ...	29.810	29.713	82.8	86.9	76.5	76.3	31.1	30.9	7.2	12.8	81	71	6.4	5.6	0	4	11	16	0	56.9	2.24	0.45	7	15	5
February ...	29.822	29.719	82.6	88.3	75.9	76.5	30.6	31.1	7.4	14.6	80	68	6.2	6.5	1	3	9	12	3	26.2	1.03	0.80	12	6	9
March ...	29.787	29.686	81.2	85.8	77.0	77.2	31.7	31.8	4.6	10.4	87	75	7.5	6.5	0	4	4	17	6	319.0	12.56	2.96	20	20	17
April ...	29.828	29.748	78.9	83.2	77.0	77.5	31.7	32.3	2.1	6.4	94	83	7.6	6.5	0	4	3	17	6	475.7	18.73	2.85	14	24	17
May ...	29.881	29.810	77.4	82.1	74.3	74.3	29.0	29.0	3.1	8.4	90	78	5.8	5.6	0	8	8	12	3	266.2	10.48	2.00	22	19	0
June ...	29.988	29.917	75.6	81.1	72.0	71.4	26.8	26.2	3.4	10.1	89	72	3.9	5.1	3	14	5	7	1	21.1	0.83	0.65	5	5	0
July ...	29.979	29.908	75.0	80.4	71.1	70.0	25.9	25.0	3.8	10.5	88	70	4.4	4.2	2	11	11	7	0	7.1	0.28	0.18	22	5	0
August ...	29.964	29.881	75.0	80.5	70.3	68.5	25.1	23.8	4.3	11.7	86	67	5.3	4.4	0	10	9	12	0	15.7	0.62	0.26	10	6	0
September ...	29.982	29.875	76.1	82.5	71.2	69.1	26.1	24.2	4.6	13.8	85	64	6.5	2.7	0	3	12	12	3	54.4	2.14	0.74	25	10	0
October ...	29.935	29.822	78.3	83.1	72.5	72.7	27.2	27.4	5.3	11.3	82	71	6.2	3.3	0	2	17	10	2	145.3	5.72	2.32	22	10	2
November ...	29.884	29.787	79.8	81.8	74.1	74.3	28.8	28.9	6.0	8.3	83	78	6.9	6.2	0	2	10	17	1	220.0	8.66	1.79	22	17	5
December ...	29.810	29.719	81.4	83.9	76.5	76.8	31.1	31.5	5.4	8.1	85	80	6.0	6.0	0	5	15	10	1	181.6	7.15	0.94	17	19	17
Year ...	29.889	29.799	78.7	83.3	74.0	73.7	28.8	28.5	4.8	10.5	86	73	6.1	5.2	6	70	114	149	26	1789.2	70.44	2.96	Mar. 20	156	72

*At station level. Corrected for temperature and to standard gravity.

Month	Frequency of Wind Directions at 8.30: N	NE	E	SE	S	SW	W	NW	Calm	Frequency of Wind Force 8.30: 1-3	4-7	>7	Mean Velocity of Wind 8.30	Mean Velocity of Wind 14.30	Extremes of Temperature of the Air: Max.	Date	Min.	Date	Mean Max.	Mean Min.	Max.+Min.÷2	Range: Max.	Range: Min.	Range: Mean	Frequency of Visibility at 8.30: Fog	Mist	Good Vis.
													mph.	mph.	F		F		F	F	F	F	F	F			
January ...	21	5	0	0	0	0	1	2	2	21	8	0	9.4	11.2	92.3	19	74.0	8	89.8	76.6	83.2	16.2	9.7	13.2	0	0	31
February ...	17	5	0	1	0	0	1	3	1	22	5	0	9.2	12.1	97.4	3	74.0	5	91.2	76.8	84.0	19.4	8.2	14.5	0	0	28
March ...	4	2	0	1	1	15	3	4	1	23	7	0	8.7	7.8	95.7	4	73.7	24	89.0	76.4	82.7	20.3	3.3	12.6	0	4	27
April ...	0	0	2	1	8	18	1	0	0	21	9	0	10.5	8.1	89.3	7	71.6	30	85.4	75.8	80.6	14.8	2.2	9.6	1	4	25
May ...	0	0	0	3	9	19	0	0	0	11	20	0	14.5	14.5	87.1	28	70.8	23	83.3	74.5	78.9	12.8	3.2	8.9	2	1	28
June ...	0	0	0	0	3	27	0	0	0	7	23	0	14.3	17.0	86.0	3	69.6	6	82.0	73.5	77.7	12.3	6.8	8.5	0	0	30
July ...	0	0	0	1	2	28	0	0	0	13	18	0	12.8	17.4	84.0	21	70.7	27	81.7	72.5	77.1	12.4	6.8	9.2	0	0	31
August ...	0	0	0	1	3	26	1	0	0	19	12	0	11.0	18.6	87.3	17	68.7	18	82.5	71.4	76.9	17.4	7.3	11.1	0	0	31
September ...	0	0	2	4	6	17	1	0	0	27	3	0	9.4	19.0	89.0	1	68.5	26	84.0	71.4	77.7	17.3	8.1	12.5	0	3	27
October ...	0	0	3	12	4	12	0	0	0	27	4	0	8.5	18.6	90.7	19	70.4	3	84.8	72.7	78.7	17.9	7.0	12.1	0	2	29
November ...	1	4	2	8	1	11	2	1	0	25	5	0	8.5	10.5	90.6	11,13	72.0	23	86.0	74.0	80.0	17.8	6.7	12.0	0	2	28
December ...	7	5	1	1	3	6	5	3	0	29	2	0	5.4	5.6	89.7	16	74.0	9,25	86.8	75.5	81.1	14.6	6.7	11.4	0	1	30
Year ...	50	21	10	33	40	179	15	13	4	245	116	0	10.2	13.4	97.4	Feb. 3	68.5	Sept. 26	85.5	74.3	79.9	20.3	2.2	11.3	3	17	345

SUMMARY OF METEOROLOGICAL OBSERVATIONS, 1938.

2nd Order Station. VICTORIA GARDENS, ZANZIBAR. **Non-Clove Growing Area.**

Latitude 6° 10′ S. Longitude 39° 11′ E. Altitude 18 feet. Observations taken at 0600 G.M.T.

Month	Temperature of the Air						Dew Point	Vapour Pressure	Saturation Deficit	Relative Humidity	Cloud Amount	Rainfall			Wind Frequencies								
	Max.	Min.	Mean Max.	Mean Min.	Max. + Min. ÷ 2	Dry Bulb						Total	Max. in 24 hours	No. of days	N	NE	E	SE	S	SW	W	NW	Calm
	°F	°F	°F	°F	°F	°F	°F	mb.	mb.	%		ins.	ins.										
January ...	94.5	74.0	91.0	77.7	84.3	84.5	77.0	31.7	8.8	77	6.2	0.84	0.33	7									
February ...	95.0	75.5	90.5	77.7	84.1	83.7	76.6	31.3	8.1	78	6.4	0.39	0.28	4									
March ...	93.0	75.0	88.2	76.8	82.5	82.2	77.4	32.1	5.5	85	7.0	11.27	2.53	17									
April ...	89.0	72.5	85.8	75.9	80.9	80.3	77.2	31.8	3.5	89	8.0	20.14	2.30	23									
May ...	87.0	72.0	84.6	74.9	79.7	78.6	75.0	29.6	3.8	89	5.4	12.78	2.19	20									
June ...	85.0	70.0	84.0	73.8	78.9	76.8	72.5	27.3	4.2	86	7.1	0.54	0.39	4									
July ...	84.5	69.5	83.2	72.2	77.7	75.7	71.6	26.5	3.9	87	7.5	0.87	0.37	6	No record								
August ...	86.0	67.0	83.3	70.2	76.7	75.5	70.3	25.4	4.8	83	7.9	0.48	0.35	5									
September ...	88.5	67.5	84.7	70.1	77.4	76.8	71.2	26.1	5.4	82	8.7	2.04	0.53	13									
October ...	89.5	67.5	85.5	71.1	78.3	79.3	72.3	27.1	7.1	78	7.7	5.14	2.12	15									
November ...	89.5	70.0	84.8	73.2	79.0	80.8	74.7	29.3	6.6	81	7.3	13.76	3.98	18									
December ...	89.0	72.0	86.3	75.0	80.7	82.1	75.9	30.6	6.8	82	6.4	5.55	1.08	19									
Year ...	95.0	67.0	86.0	74.1	80.0	79.7	74.3	29.1	5.7	83	7.1	73.80	3.98	151									

Temperature Station. DUNGA. **Clove Growing Area.**

Latitude 6° 08′ S. Longitude 39° 20′ E. Altitude 100 feet.

January ...	94.0	70.0	90.7	74.5	82.6	84.8	74.7	29.3	11.5	70	6.2	1.74	1.09	8	
February ...	94.0	70.0	90.6	73.9	82.3	83.0	75.4	30.0	8.5	77	6.4	1.26	0.57	8	
March ...	93.0	71.0	89.2	73.1	81.1	81.4	75.9	30.6	5.9	83	7.2	12.51	4.05	17	
April ...	91.0	69.0	86.6	72.2	79.4	79.5	75.9	30.6	3.6	88	6.9	21.36	2.30	26	
May ...	90.0	69.0	85.2	71.2	78.2	78.5	74.5	29.1	4.1	87	6.3	16.22	2.30	23	
June ...	87.0	64.0	84.6	67.6	76.1	77.7	72.7	27.4	5.0	83	5.4	2.15	1.03	10	
July ...	86.0	64.0	84.1	66.9	75.5	76.3	72.0	26.8	4.1	86	6.8	1.45	0.32	10	No record
August ...	88.0	62.0	84.1	64.7	74.4	76.4	71.6	26.5	4.6	85	6.8	1.55	0.65	10	
September ...	90.0	61.0	85.8	65.1	75.5	77.8	71.1	26.0	6.4	79	6.0	1.37	0.28	13	
October ...	89.0	62.0	85.7	66.6	76.1	78.8	72.1	27.0	6.6	80	6.6	4.73	2.18	14	
November ...	91.0	64.0	86.5	69.6	78.1	80.7	74.3	29.0	6.9	80	6.8	13.39	2.96	23	
December ...	91.0	67.0	87.5	71.5	79.5	81.5	76.1	30.8	5.9	83	5.7	8.05	1.36	22	
Year ...	94.0	61.0	86.7	69.7	78.2	79.7	73.9	28.6	6.1	82	6.4	85.78	4.05	184	

Temperature Station. KIZIMBANI EXPERIMENTAL STATION. **Clove Growing Area.**

Latitude 6° 05′ S. Longitude 39° 16′ E. Altitude 220 feet.

January ...	91.0	69.0	89.1	73.2	81.1	82.7	75.2	29.8	8.5	77	3.8	0.97	0.33	6	5	24	0	0	0	1	0	1	0
February ...	95.0	71.0	90.4	74.1	82.3	82.8	74.8	29.5	8.8	76	4.7	0.39	0.39	1	2	26	0	0	0	0	0	0	0
March ...	93.0	72.0	88.1	74.2	81.1	82.0	75.7	30.3	7.1	80	6.3	11.19	2.45	19	1	3	0	0	0	0	25	2	0
April ...	89.0	72.0	83.9	73.4	78.7	79.4	75.4	30.0	4.2	87	6.6	15.92	2.55	24	0	0	0	0	1	24	5	0	0
May ...	88.0	70.0	82.8	72.7	77.7	77.4	73.6	28.3	3.8	87	6.7	17.04	2.48	21	0	0	0	0	21	10	0	0	0
June ...	83.0	67.0	81.9	69.5	75.7	75.8	71.6	26.5	3.9	86	4.4	1.35	0.60	7	0	0	0	5	0	23	2	0	0
July ...	83.0	62.0	81.3	67.7	74.5	74.5	69.8	24.9	4.2	84	4.3	0.95	0.65	5	0	0	0	2	14	14	1	0	0
August ...	85.0	63.0	82.1	66.4	74.3	74.9	69.1	24.3	5.2	82	3.9	0.75	0.25	7	0	0	0	2	17	2	10	0	0
September ...	87.0	64.0	82.9	66.7	74.8	76.8	68.7	24.0	7.5	75	3.4	2.06	0.97	9	0	0	9	0	18	0	3	0	0
October ...	87.0	65.0	83.5	68.4	75.9	78.3	70.3	25.3	7.7	75	3.6	5.83	2.80	16	4	0	7	0	19	0	1	0	0
November ...	86.0	67.0	83.3	70.3	76.8	79.6	73.0	27.7	6.7	79	3.1	17.22	3.53	22	7	0	6	0	13	0	4	0	0
December ...	92.0	70.0	84.7	72.0	78.3	80.8	74.3	29.0	6.9	81	3.1	12.90	2.90	22	14	0	2	0	15	0	0	0	0
Year ...	95.0	62.0	84.5	70.7	77.6	78.7	72.6	27.5	6.2	81	4.5	86.57	3.53	159	33	53	24	9	118	74	51	3	0

Temperature Station. WESHA AND WETE, PEMBA. **Clove Growing Area.**

Latitude 5° 14′ S. Longitude 39° 44′ E. Altitude 100 feet. Observations taken at 0600 G.M.T.

January ...	93.0	74.0	89.9	75.7	82.8	83.1	76.3	30.9	7.8	79	8.1	1.46	0.40	13	6	0	2	0	0	0	6	12	0
February ...	95.0	73.0	90.9	75.5	83.2	84.3	75.0	29.7	10.6	73	7.4	1.89	1.85	3	4	1	1	0	0	0	16	6	0
March ...	96.5	73.0	91.5	75.8	83.7	82.8	76.5	31.1	7.2	80	8.4	7.15	3.33	10	4	0	4	0	1	0	17	0	5
April ...	91.5	72.0	86.8	74.7	80.7	80.8	76.3	31.0	4.9	86	8.2	17.50	5.00	23	0	0	4	2	16	0	5	0	3
May ...	88.5	70.0	84.0	72.3	78.1	79.1	74.5	29.1	4.9	85	8.5	16.94	2.75	22	0	0	2	1	22	0	1	0	5
June ...	88.5	68.5	82.2	70.6	76.4	77.3	71.6	26.4	5.7	82	8.7	3.65	1.32	16	1	0	9	3	16	0	0	0	1
July ...	84.0	62.5	81.5	69.2	75.3	76.6	70.5	25.5	5.8	81	9.3	1.87	0.62	15	0	1	8	5	13	1	0	0	3
*August ...	84.5	65.0	82.0	66.8	74.4	76.6	68.4	23.7	7.6	74	5.1	1.96	0.72	11	0	0	0	0	10	15	0	0	0
September ...	88.0	64.0	84.8	67.3	76.1	78.9	68.8	23.9	9.9	69	5.0	0.57	0.19	6	0	0	0	0	0	19	0	0	11
October ...	90.0	65.0	86.0	68.7	77.3	81.6	69.4	24.5	12.4	65	6.0	5.07	2.48	8	0	9	1	0	0	7	3	0	11
November ...	88.0	67.5	85.0	71.0	78.0	81.0	72.7	27.4	8.7	75	6.9	10.63	1.80	13	0	17	0	0	0	0	2	0	11
December ...	89.0	71.0	86.4	72.3	79.3	80.7	73.8	28.5	7.4	79	7.1	11.95	2.10	21	0	1	0	0	0	0	3	0	27
Year ...	96.5	62.5	85.9	71.7	78.8	80.2	72.8	27.6	7.7	77	7.4	80.64	5.00	161	15	29	31	11	78	42	53	18	77

* From 7th August onwards observations of temperature and cloud taken at Wete.

RAINFALL STATIONS, 1938.

Months	Clove Growing Areas																		Non Clove Growing Areas			
	ZANZIBAR								PEMBA										ZANZIBAR			
	Kidichi		Machui		Selem		Mkokotoni		Kigomacha		Matangatwani		Mkoani		Mtambili		Wete		Chwaka		Makunduchi	
	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days
January	1·14	5	1·21	10	1·57	5	0·77	3	0·11	1	0·59	6	0·83	14	5·31	23	0·48	3	0·54	2	0·71	2
February	0·54	4	0·63	4	0·36	4	0·54	1	2·40	3	3·67	5	1·23	1	3·66	5	2·76	4	1·76	3	1·12	2
March	10·39	19	9·10	19	6·30	19	13·39	14	4·17	8	12·64	13	3·23	10	10·30	15	3·36	10	18·48	13	15·93	12
April	16·23	23	15·28	26	19·87	23	20·72	25	9·02	13	13·18	26	15·60	17	13·58	23	17·78	29	11·91	17	24·76	18
May	11·50	16	16·59	21	12·39	21	7·85	16	15·98	22	17·35	26	21·44	23	23·09	28	19·50	26	12·87	17	13·97	15
June	1·53	7	1·73	6	1·19	7	2·50	8	6·43	16	5·58	18	5·58	10	4·09	15	5·07	18	1·23	7	2·18	6
July	0·92	11	1·47	7	1·07	8	2·59	8	5·08	13	4·01	12	1·07	5	1·00	11	2·57	14	1·65	7	0·94	2
August	0·91	5	0·93	9	0·73	7	5·13	14	2·92	13	2·90	17	1·02	5	1·05	6	1·54	9	0·75	5	0·78	3
September	1·46	10	2·31	10	2·22	15	1·70	8	2·53	10	0·97	7	0·07	2	0·59	5	0·46	4	0·23	1	0·20	1
October	5·72	9	4·15	14	7·73	15	7·96	8	6·95	12	7·26	18	5·70	13	5·26	12	5·99	14	3·41	4	4·75	5
November	15·11	21	14·75	21	11·83	22	9·60	12	7·40	20	14·39	21	14·57	16	13·96	18	12·56	21	4·47	9	2·67	7
December	12·37	25	14·08	21	13·94	22	3·95	11	5·52	14	12·05	21	9·71	15	13·82	27	10·26	18	5·91	11	3·04	6
Total 1938	78·18	155	82·23	168	79·20	168	76·70	128	68·51	145	94·59	190	80·05	131	95·71	191	82·33	170	63·21	96	71·05	79
Total 1937	76·68	149	76·38	147	71·38	158	60·10	97	81·96	117	77·30	180	87·76	138	98·29	184	76·36	140	60·42	88	72·64	69

Note:—Rainfall in inches

APPENDIX II.

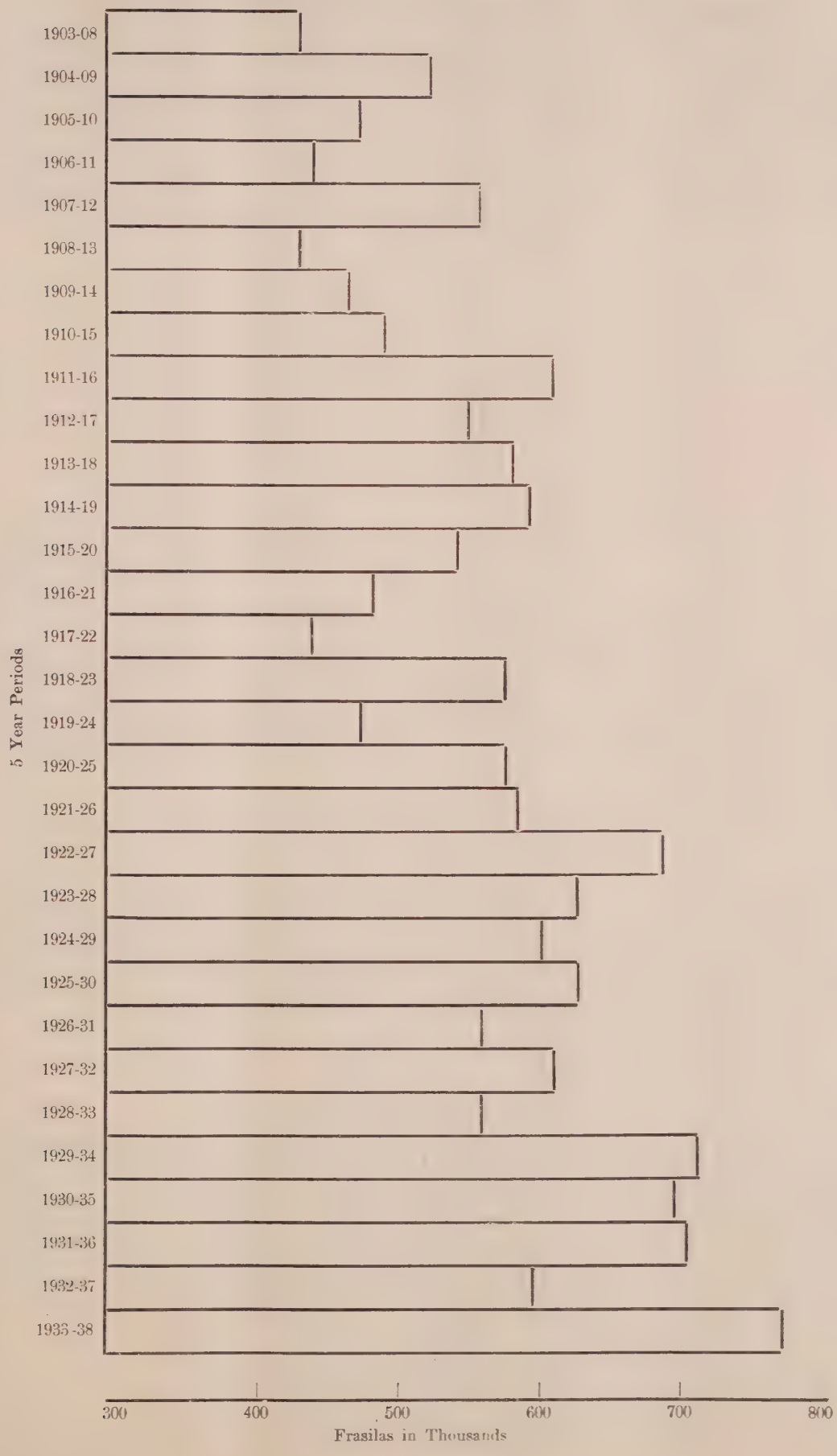
Approximate Production of Cloves in Frasilas of 35 lbs. for 35 Crop Years. (1st July to 30th June).

(Based on receipts of cloves at the Customs Clove Depôt).

Season	Zanzibar	Pemba	Total	Mean Crop per season in five year periods
	Fras.	Fras.	Fras.	Fras.
1903/04	27,000	99,000	126,000	—
1904/05	81,000	654,000	735,000	—
1905/06	178.435	129,735	308,170	—
1906/07	63,004	203,496	266,500	372,000
1907/08	213,662	541,993	755,655	438,000
1908/09	165,727	449,691	615,418	536,000
1909/10	109.678	300,047	409,725	471,000
1910/11	52.100	139,307	191,407	448,000
1911/12	216,507	582,153	798,660	554,000
1912/13	31,018	104,368	135,386	430,000
1913/14	145,586	638,094	783,680	464,000
1914/15	194,920	331,389	526,309	487,000
1915/16	141,641	655,116	796,757	608,000
1916/17	208,716	302,919	511,635	551,000
1917/18	63,958	234,239	298,197	583,000
1918/19	259,273	565,229	824,502	591,000
1919/20	93,847	168,703	262,550	539,000
1920/21	231,831	316,446	548,277	489,000
1921/22	65,819	200,983	266,802	440,000
1922/23	291,417	690,498	981,915	577,000
1923/24	75,027	236,767	311,794	474,000
1924/25	240,952	520,490	761,442	574,000
1925/26	219,192	392,622	611,814	587,000
1926/27	203,843	529,186	733,029	680,000
1927/28	190,370	500,382	690,752	622,000
1928/29	74,828	125,740	200,568	600,000
1929/30	318,647	610,296	928,943	633,000
1930/31	51,796	201,320	253,116	561,000
1931/32	175,070	760,786	935,856	602,000
1932/33	242,772	244,594	487,366	561,000
1933/34	146,098	781,090	927,188	706,000
1934/35	360,037	503,415	863,452	693,000
1935/36	65,938	232,571	298,509	702,000
1936/37	45,096	351,568	396,664	595,000
1937/38	446,500	909,416	1,355,916	768,000
Average for 35 Seasons	162,609	405,933	568,542	

APPENDIX III.

Graph Showing Average Clove Crops per Seasonal Year in 5 Year Periods.



APPENDIX IV.

Report of the Assistant Manager of Government Plantations.

Plantation Management.—Mr. J. M. Jamison was appointed Assistant Manager of Plantations on the 1st January, 1938. This appointment was made owing to the secondment of Mr. I. G. C. Squire as Valuation Officer under the Debt Redemption Scheme. Mr. Squire undertook his full time duties as Valuation Officer in February when Mr. Jamison assumed charge of the Government Plantations until the end of the year.

Together with the areas at Kidichi relinquished by the Kizimbani Experiment Station at the beginning of 1938, the total extent of land now under control of the Plantations Section is approximately 9,500 acres. The following table shows the system of grouping adopted for convenient Estate Management, and also the approximate number of trees carried by each group.

TABLE I.

		Number of Trees.			
		Cloves.		Coconuts.	
Group.	Acreage.	Bearing.	Non-bearing.	Bearing.	Non-bearing.
Machui	1,830	24,800	3,490	28,660	14,850
Kidichi	3,100	23,300	4,040	34,840	14,810
Selem	2,150	12,150	730	17,920	5,420
Mtoni	1,190	7,100	1,040	20,820	18,770
Chukwani	1,130	20	...	11,750	4,170
Town, etc.	100	30	...	4,410	480
Total	9,500	67,400	9,300	118,400	58,500

There were no sales of land effected during the year. Government has under consideration, however, the disposal of a number of shambas during 1939.

The full complement of Overseers provided in the Estimates for the supervision of the above groups in 1938 was 2 Overseers (Range III), 6 Assistant Overseers (Range IV) and 3 Junior Overseers (Range V). Of these, one Overseer (Range III) was seconded to the Experiment Section, one post of Assistant Overseer (Range IV) remained vacant throughout the year, and one Assistant Overseer (Range IV) retired in May and this post remains vacant also. It is intended to employ the services of the pupils at present in training at Kizimbani should it be found necessary to fill vacancies in the Overseer Staff.

As is customary, Government Plantations in Pemba are not included in this report as they are controlled by the Agricultural Officer, Pemba. They are of insignificant extent.

CLOVES.

Harvesting.—Picking of the 1937/38 crop was continued until the 28th January, 1938, when it was found necessary to close down, leaving very considerable quantities of over-ripe cloves on the trees, the available labour being quite unable to cope with the full crop. The quantity picked during the period January 1st to 28th was, in terms of dry cloves, 100,197 lbs. Allowing for shrinkage in godown of 2,181 lbs. the net sale weight of cloves was 98,016 lbs. or 2,800.4 frasilas (approximately 25% of the total season's crop). The total crop for the season 1937/38 was:—

293,043 lbs. harvested in 1937
98,016 ,, ,, ,, 1938

391,059 lbs. or 11,173.1 frasilas sale weight.

The rate paid to pickers during January was 18 cents per pishi (green). This was a slight but unavoidable increase on the rate of 15 cents paid at close of 1937.

TABLE II.

COMPARATIVE FIGURES FOR FOUR SEASONS.

Season.	Shamba Weight Frasilas.	Sale Weight Frasilas.	Average Price Per Frasilas	Per lb.
1934/35	13,193.3	13,125.3	Shs. 10.95	Cts. 31.3
1935/36	933.2	921.2	,, 12.74	,, 36.4
1936/37	310.1	306.8	,, 18.27	,, 52.2
1937/38	11,235.4	11,173.1	,, 13.04	,, 37.3

Plantation Stems.—The total stems for season 1937/38 amounted to 78,842 lbs. shamba weight, or 78,080 lbs. sale weight. Of these, 18,008 lbs. sale weight were sold in 1937 at an average price of Shs. 6.64 per 100 lbs., the balance (60,072 lbs.) sold in 1938 realized an average price of Shs. 6.87 per 100 lbs. The average price for the season's crop of stems was, therefore, Shs. 6.82 per 100 lbs. The quantity of stems (78,842 lbs.) in relation to cloves was approximately 20%—a normal percentage.

Season 1938/39.—As was expected, very few trees were in new bearing during 1938, and the resulting crop was, therefore, insignificant. A very small *mwaka* crop was picked by estate labour in June and July. Towards the end of the year the usual *mvuli* inflorescence made its appearance, but was also inconsiderable. The latter crop was picked partly by estate labour and partly by regular pickers. Although picking of the small *mvuli* crop was not completed until January, 1939, the figures quoted below give the final total of this crop.

TABLE III.

TOTAL CLOVE CROPS SEASON 1938/39.

	Shamba Weight Frasilas.	Sale Weight Frasilas.	Average Price Per Frasila.	Average Price Per lb.
		"Mwaka" Crop		
	65.9	65.4	Shs. 15.11	43.2 cts.
		"Mvuli" Crop		
	437.2	435.0	Shs. 16.33	46.7 cts.
Total	503.1	500.4	Shs. 16.17	46.2 cts.

Condition of Trees.—Trees generally may be said to be in excellent condition, and have greatly benefited from the rest they have had subsequent to the heavy 1937/38 crop. New leaf growth has been almost prolific, even during the drier months of the year, so that the trees should be able to stand up to a heavy crop, given other normal conditions in 1939.

Cultivation.—The plantations were well maintained in a good state of cultivation throughout the year, except perhaps during the last two months when, for financial reasons, the labour roll was considerably reduced. During this short period the small field staff available could not keep pace with undergrowth resulting from heavy and continuous rain.

Supplying.—During the *masika* rains some 3,150 selected clove seedlings were obtained from public nurseries, and planted. Unfortunately they were for the most part of poor quality, and many will need replacing during the coming year.

COCONUTS.

Harvesting.—The total production of nuts for all plantations amounted to 3,595,007, the yield per tree climbed being 56.6 nuts. In relation to the number of actual bearing trees (including those not climbed) the average number of nuts obtained was 35.6 as compared with 37.1 in 1937 and 31.7 in 1936. In addition to the foregoing, 22,985 nuts were bought from the Experiment Section, and 88,130 nuts were brought forward from the 1937 account, making a grand total of 3,706,122 accounted for as below:—

Made into copra	...	2,585,526
Sold on the heap	...	1,102,149
Rotten	...	18,447
Total	...	3,706,122

The larger number of nuts produced in 1938 is, of course, a natural consequence of the increased area now under the Plantation Section's control. An even larger number of nuts was at one time expected, but the third and fourth gatherings did not fulfil expectations either in quantity or in quality. The increase in production was mainly responsible for the heavy sales from heaps, as kiln capacity was insufficient to utilize more nuts for copra-making. Further, the fourth gathering was completed late, and it was found more convenient to sell most of the crop before the end of the financial year. The total nuts sold during the year (1,102,149) represented 30.6% of the total production. Ruling prices were low, the average obtained being only Shs. 18.70 per thousand as against Shs. 29.40 in 1937. Comparison with previous years is given in Table IV below:—

TABLE IV.

AVERAGE PRICE PER 1,000 NUTS.

	1938.	1937.	1936.	1935.	1934.
Shs.	18.70	29.40	29.11	22.41	10.95

Lease of Crops.—The unremunerative state of the coconut and copra market in 1938 was reflected in the leasings of quarterly crops on certain outlying plantations and town plots. As against a net revenue in 1937 of Shs. 7,563.22, only Shs. 3,128.27 was derived from this source in 1938. The gross revenue per tree in 1937 was 69 cents while in 1938 only 27 cents could be realized.

Cultivation.—Except at the beginning of the year when there was a rush in clove picking, labour was plentiful, and in consequence plantations received considerable attention. Hoeing was effected on a large scale except in uneconomic areas such as Chukwani, where only slashing undergrowth is attempted. The system of burying manure at Mtoni was extended to Marhubi. Some of the plantations, however, are in sore need of regeneration. Many old palms have passed their economic productive value. Unfortunately, large quantities of good seedlings are not available, but in co-operation with the Experiment Station, a scheme for new supplies of seedlings from selected palms is being evolved at Machui. The full advantages of this scheme, however, will not be available until 1941. Some 560 seedlings were obtained from Kizimbani in 1938 and these were planted in gaps at Machui.

COPRA.

During the year under review 2,585,526 coconuts were utilized for copra-making. These represent approximately 69% of the total nuts available. 417.03 tons of copra were produced at the rate of 6,201 nuts per ton. The rates for 1937 and 1936 were 6,281 and 6,219 nuts per ton respectively. All copra manufactured in 1938 was sold before the close of the year and realized Shs. 63,182.07 (£3,159) or an average price of Shs. 6.88 per 100 lbs. This represents a fall in the average selling price of copra of some 38% as compared with the previous year. The following Table V gives the comparative price per 100 lbs. for the last six years.

TABLE V.

AVERAGE PRICE REALIZED PER 100 lbs. OF COPRA.

	1938.	1937.	1936.	1935.	1934.	1933.
Shs.	6.88	11.12	10.63	8.45	5.36	6.50

Agents' selling commission at the rate of 25 cents per 100 lbs. amounted to Shs. 2,296.03, leaving a net balance of revenue from copra of Shs. 60,886.04.

REPAIRS TO PLANTATION HOUSES.

Three major works were completed during the year.

(1) The old Tool Store at Selem was demolished, and a new one erected on the same site.

(2) At Mtoni the building containing the office, store and Overseer's quarters, was reconstructed. The lower portion of the building was cut away in sections and reinforced with stone and cement.

(3) Substantial repairs were effected to the various buildings at Mlangos (Kidichi), thus enabling transfer of the Kidichi office and staff from Mdo.

Other repairs of a more minor nature were carried out at various plantation centres.

REPAIRS TO COPRA FACTORIES.

Three new kilns of the Seychelles type were constructed during 1938. One each at Chukwani, Mdo and Kitumba. These kilns have been designed to take 1500/2000 nuts every three days. They are easy and cheap to construct, and with reasonable care, and regularity in fuelling, they produce a good clean quality copra.

Substantial repairs to most of the existing kilns at various centres were effected during the year.

A number of old kilns at Kizimbani Experiment Station were transferred to the Plantations Section, and are now operated within the Kidichi Group.

GENERAL.

In addition to the usual estate work, the Plantation Section co-operated with the Experiment Station in various other useful work, such as recording in Citrus and "sudden death" plots, planting of maize at Kidichi, pineapples at Selem, and various crop trials in typical *wanda* areas.

FINANCE.

REVENUE.

The year 1938 was a disappointing one as regards revenue, the three main reasons being:—

(1) A negligible clove crop.

(2) A smaller crop of coconuts than was originally estimated.

(3) The exceptionally low prices obtained for coconuts and copra.

The total revenue collected during the year amounted to Shs. 143,821.35. As this figure included a carry over from 1937 of Shs. 13,889.27 the net revenue was therefore Shs. 129,932.08.

EXPENDITURE.

In view of the anticipated shortfall of revenue all possible economies were made in order to reduce expenditure, although due regard was paid to the necessity of maintaining plantations in a good state of cultivation. The total expenditure for the year was Shs. 158,371.98. This figure, however, included salaries of the Manager of Plantations (seconded to the Debts Settlement Department) and one Overseer Range III (seconded to the Experiment Section). Consequently, a reduction under this Head of Shs. 15,937.43 brings the net expenditure for the year to Shs. 142,434.55. The loss on the year's working was therefore Shs. 12,502.47.

The following Table VI summarizes revenue and expenditure for the year.

Table VI.

REVENUE.

		Shs. Cts.	Shs. Cts.
Cloves:			
Sale of Cloves	...	50,988 88	
,, ,, Stems	...	4,323 38	
,, ,, Crops	...	637 00	55,949 26
Coconuts:			
Sale of Coconuts	...	20,609 07	
,, ,, Copra	...	61,922 92	
,, ,, Crops	...	3,144 00	
Lease of Plantations	...	1,200 00	
		86,875 99	
Less Cost of nuts bought	...	420 90	86,455 09
Miscellaneous	...	1,417 00	1,417 00
		Total ...	143,821 35
Less Value of Carry Over of 1937:			
Cloves	...	10,913 53	
Coconuts	...	1,938 86	
Copra	...	1,036 88	13,889 27
Net Revenue for the Year	...		129,932 08

EXPENDITURE.

Headquarters Division:			
Personal Emoluments	...	31,813 32	
Other Charges	...	1,763 11	33,576 43
Field Division:			
Personal Emoluments	...	10,478 32	
Other Charges	...	114,317 23	124,795 55
		Total ...	158,371 98
Less—			
Manager of Plantations' salary for whole year (chargeable to Debt Settlement)	...	13,777 43	
Range III Overseer's salary for whole year (chargeable to Experiment Station)	...	2,160 00	15,937 43
Net Expenditure for the Year	...		142,434 55

APPENDIX V.

Report of the Government Chemist.

STAFF.

Laboratory Assistant, Mr. A. G. Kark, was on privilege leave in India until May 23rd.

The Government Chemist was required to take charge of the Municipal and Land Offices in addition to the Laboratory from the 19th November to the 10th December, and was on local leave from the latter date until the end of the year. During the period of local leave the Director of Agriculture was gazetted as Acting Government Chemist.

Agricultural Pupil Ali bin Amin was seconded from the Experimental Section for some weeks to assist in a special investigation.

Agricultural Pupil Abdulla Juma was attached to the Laboratory from 21st June for training as a Laboratory Assistant, Range IV.

Early in the year the facilities of the Laboratory were placed at the disposal of Mr. André Moutia, of the Department of Agriculture, Mauritius, who spent some weeks in Zanzibar in a search for parasites of a sugar-cane pest.

From the date of his arrival in the Protectorate, Dr. A. H. Campbell, the officer appointed to investigate the "sudden death" disease of clove trees, was given accommodation in the Laboratory and the assistance of the staff. The results of relevant research carried out in past years by the Government Chemist have been placed fully at Dr. Campbell's disposal.

EQUIPMENT.

The stock of apparatus and chemicals was adequately maintained, but funds did not admit of any notable additions. Petrol consumption in the "Silverlite" gas-plant, which supplies three Laboratories, was slightly less than last year at approximately 112 gallons.

CHEMICAL WORK.

The chemical work of the Laboratory is summarized below under A. General Analyses, B. Agricultural Investigations and C. Miscellaneous.

A. General Analyses.

The total number of samples received was 791 (compared with 495 in 1937) of which 698 were from Government Departments, 42 from the Clove Growers Association, 20 from the Government of Tanganyika Territory and 31 from private firms.

A sum of Shs. 1,337-50 cts. was received in fees by Government for samples analysed for the Clove Growers Association and private firms and in respect of the export certification of clove oil.

The distribution of samples is shown in Table I.

TABLE I.

Department.	1st quarter.	2nd quarter.	3rd quarter.	4th quarter.	Total.
Agriculture ...	119	124	244	92	579
Health ...	7	6	3	1	17
Police ...	8	9	13	2	32
Customs ...	10	22	20	5	57
Other Departments ...	3	5	5	—	13
Total Government ...	147	166	285	100	698
Tanganyika ...	—	—	—	20	20
C.G.A. ...	31	6	5	—	42
Private ...	1	—	5	25	31
Total ...	179	172	295	145	791

Details of the Government samples are as follows:—

Agriculture.—Cloves, clove stems, 100; clove oil, 360; copra, 4; cattle dips, 30; milk, 49; water, 11; fertilizers, 14; other samples, 11; Total, 579. (323 in 1937).

Health.—Milk, 5; water, 7; other samples, 5; Total, 17. (17 in 1937).

Police.—Opium, 5; bhang, 8; liquors, 15; other exhibits, 4; Total, 32. (26 in 1937).

Customs.—Condensed milk, 48; methylated spirit, 9; Total, 57. (32 in 1937).

Other Departments.—Post Office, medicines, 8; Public Works and Electricity, various, 5; Total, 13. (13 in 1937).

Notes on the More Important Samples.

Agriculture.—In connexion with an investigation of the losses incurred during shipment of cloves from Pemba to Zanzibar 92 samples were tested for moisture. The investigation involved a large number of weighings in the sheds. A special hopper was designed to facilitate the sampling of bags of cloves by quartering.

The export of clove stem oil from the Clove Growers Association Distillery continued to increase. Sampling was carried out by Inspector of Produce. Towards the end of the year the installation of a bulk storage tank enabled the number of samples to be reduced. Three hundred and sixty samples were examined, five being oil from technical grade cloves and the remainder stem oil: these represented 421 drums and four tins of oil, weighing 226,558 lbs. or approximately

101 tons, as against 46½ tons in 1937. The eugenol content of all samples was determined and ranged from 90 to 94 per cent, 308 samples falling between 91 and 93 per cent. Refractive index (20°C.) of 100 samples varied from 1.5337 to 1.5365. Solubility of the same samples in 70 per cent alcohol was from 1 in 0.75 to 1 in 1.0, most samples showing 1 in 0.8.

Thirty samples of cattle dipping fluid were examined. Eight were of correct stength, 12 were below and six above strength. Two samples from Pigaduri tank showed an unusually high content of arsenate which appeared to increase on keeping the samples. The phenomenon has not yet been fully investigated.

Forty-nine samples of milk were received from the Government Dairy, Mtoni. For a time calves were being suckled and some abnormal results were obtained, but the average figures are not seriously affected.

	Highest.	Lowest.	Average.	Average in 1937.
	%	%	%	%
Total solids ...	16.55	11.93	14.05	14.00
Fat ...	6.95	2.35*	4.65	4.55
Solids-not-fat ...	9.90	8.63	9.40	9.45

Regular chemical examinations of samples from the Zanzibar Public Water Supply were made throughout the year. The results showed remarkable uniformity and the water maintained a high degree of organic purity. Table II shows the range of the analytical figures.

TABLE II.

	Parts per 100,000.
Total solids (dried at 105°C.) ...	32.9—35.0
Alkalinity (as calcium carbonate) ...	28.8—30.2
Chlorides (as sodium chloride) ...	1.8— 2.4
Nitrogen, in free and saline ammonia ...	nil—0.001
do. in albuminoid ammonia ...	less than 0.001—0.0016
do. in nitrates ...	0.02—0.04
do. in nitrites ...	nil.
Oxygen absorbed from potassium permanganate, 4 hrs., 80°F. ...	0.002—0.0098

Other samples analysed for the Agricultural Department included fertilizers, pineapples, ground-nut cake (castor seed absent), *popondo* beans, citronella and ginger grass and sodium arsenite.

Health.—In five cases in which samples of milk from public supplies were submitted by Sanitary Inspectors the following percentage deficiencies were found:—

Solids-not-fat. (standard 8.5%)	Fat. (standard 3.0%)
7.65	—
33.9	35.0
28.7	—
79.8	76.7
37.3	26.7

Five samples of pond water were examined in connexion with Bilharzia research and samples of the Wete and Chake supplies were tested.

Other samples examined for the Health Department were flour (2), palm oil, chloroform and cattle dip.

Police.—Opium was indentified in five exhibits submitted by the Police and Bhang (Indian Hemp) in eight (in one case mixed with tobacco).

Seven liquors sent by the Police were found to be non-alcoholic and seven alcoholic. One sample of "date wine" in an early stage of fermentation contained less than 2 per cent of alcohol; three other samples of the finished product contained 25.4, 26.5 and 38.6 per cent by volume of alcohol. One sample of methylated spirit was found to be correctly denatured.

No poisonous substance could be detected in a sample of "bread" which was suspected to have caused toxic symptoms.

Two coins were found to be genuine.

Nearly ten per cent of a heavy oil was extracted from the ashes and fragments of cloth taken from the body of a native who had died of burns under suspicious circumstances.

Customs.—Of 48 samples of sweetened condensed milk, 38 contained not less than 9 per cent of fat, the range being 9.0 to 9.9 per cent and the average 9.23 per cent. Ten samples rejected showed comparatively small deficiencies, the fat contents being 8.75 to 8.9 per cent.

All nine samples of methylated spirit were correctly denatured, but one was insufficiently coloured with methyl violet.

Post Office.—No dangerous drugs were found in nine Indian and native medicines imported through the post.

Public Works.—Four samples of water from springs and wells and one sample of petrol were analysed.

*An abnormal sample.

Clove Growers Association.—Samples analysed for the Association included cloves, khoker, sweepings, clove stems, clove oil, deposit from clove oil drums, condenser water, furnace clinker and sludge from oil settling tanks.

Private.—Thirty samples received from a firm engaged in cargo surveys included 12 pieces of gunny bag, 13 samples of sugar, four of rice and one of timber, all examined for salt water damage.

The oil content of a sample of oil cake was determined in connexion with fire insurance.

Tanganyika Territory.—At the request of the Director of Agriculture, Tanganyika, the oil content of 20 samples of sesame seed was determined.

Two hundred and ninety-seven written reports were made on the above analyses.

B. Agricultural Investigations.

(*a*) *Soils.*—Little work on soil was carried out during the year, beyond the field examination of some of the latrine pits which the Health Department dug in rural areas; these revealed a number of interesting profiles and it is a matter of regret that fuller advantage could not be taken of this opportunity of accumulating data for soil mapping.

(*b*) *Cloves.*—Twenty samples of cloves from individual trees were analysed. The investigation of the oil content of clove stems prepared in different ways was completed and interesting and useful results were obtained. Particular interest attached to the analysis of different parts of clove stems. The oil content varied from 2.1% in the main stalk by which the bunch is attached to the twig, to 9.7% in the small "knuckles" adjoining the buds.

The supply of nutrient solutions was continued for the pot experiments on clove seedlings which are in progress at Kizimbani.

A good deal of time was spent in the field carrying out injection experiments on clove trees; the course followed by injected dyes was traced in several cases. Some preliminary experiments were made on the distribution of starch in the clove tree.

At the request of the Clove Growers Association the action of clove oil on galvanized iron was investigated.

Further cellophane bags were made for use in clove flower fertilization experiments.

(*c*) *Coconuts.*—A commencement was made on an investigation of the oil content of copra prepared by sun-drying and on different types of kiln, but tests so far conducted are not numerous enough for definite conclusions to be drawn.

A gas-heated retort for the small-scale preparation of coconut-shell charcoal was designed and was made in the P.W.D. Workshops. Tests indicated that the shells from 1,000 nuts might yield 1 cwt. of charcoal, and analyses of the charcoal prepared showed it to be of good quality.

(*d*) *Essential Oils.*—Samples of Ginger grass and Citronella grass (2) were distilled and the oils characterised.

(*e*) *Other Products.*—The experiments on the utilization of waste blood from the slaughter-house, referred to in last year's Report, were completed. A satisfactory and simple method was found of preparing a mixture of dried blood and bran. The poultry ration at Kizimbani was re-designed, using this mixture in place of bran and dried shark.

C. Miscellaneous.

Solutions were prepared as required for the Pathological Laboratory, Medical Department.

For the Police a solution was made which assisted in detecting the person responsible for maliciously draining the radiators of motor cars.

Tests were made, in conjunction with officers of the Public Works Department on the new water-chlorinating plant installed for emergency use at the Saateni pumping-station.

The poisoning of wild pig has been under the control of the Administration for some years. The assistance of the Agricultural Department was enlisted in August and an intensive campaign was started. Weighed doses of sodium arsenite (each equivalent to about 30 grains of arsenious oxide) were issued by the Laboratory. Up to the end of the year 6,950 doses had been sent out, including 1,000 to Pemba. This work has taken up a great deal of the time of the Agricultural Pupil who is in training.

OTHER WORK.

A floating compass from one of the Government steamers was repaired for the Port Office.

Lectures were given to the Museum Society on "Chemistry in the Detection of Crime" and to pupils in training as Sanitary Inspectors on "Air and Water" and "Thermometry".

The Government Chemist has been a member of the Board of Management of the Clove Growers Association throughout the year.